

FLORA of the U.S.S.R.

Volume XIV

B.K. Shishkin, Editor

Geraniales, Sapindales, Rhamnales

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Botanical Institute of the Academy of Sciences of the USSR

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Volume XIV

Geraniales, Sapindales, Rhamnales

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TABLE OF CONTENTS

	Russian page	English page
Systematic Index of Species in Volume XIV.....	vi	ix
Preface	v	1
Order 24. Geraniales Lindl.	1	3
Family LXXIX. Geraniaceae J. St. Hil.	1	3
Key to Genera	1	3
Tribe 1. Geranieae Benth.	2	3
Genus 830. <i>Geranium</i> L.	2	3
Genus 831. <i>Erodium</i> L'Hér.	63	49
Genus 832. <i>Pelargonium</i> L'Hér.	73	56
Tribe 2. Biebersteinieae (Endl.) Boiss.	73	58
Genus 833. <i>Biebersteinia</i> Steph.	74	58
Subgenus 1. <i>Eubiebersteinia</i> Vved.	74	58
Subgenus 2. <i>Achillaeophyllum</i> Vved.	75	59
Family LXXX. Oxalidaceae Lindl.	76	59
Genus 834. <i>Oxalis</i> L.	76	60
Family ★ Tropaeolaceae Juss	83	66
Genus ★ <i>Tropaeolum</i> L.	84	66
Family LXXXI. Linaceae Dumort.	84	67
Key to Genera	85	67
Genus 835. <i>Radiola</i> Roth.	85	67
Genus 836. <i>Linum</i> L.	86	68
Family LXXXII. Zygophyllaceae Lindl.	146	112
Key to Genera	147	113
Subfamily 1. Peganoideae Engl.	147	113
Genus 837. <i>Pegānum</i> L.	147	113
Genus 838. <i>Malacocarpus</i> Fisch. et Mey.	150	115
Subfamily 2. Tetradiclidoideae Engl.	150	116
Genus 839. <i>Tetradiclis</i> Stev.	151	116
Subfamily 3. Zygophylloideae Engl.	152	116
Genus 840. <i>Zygophyllum</i> L.	152	117
Subgenus 1. <i>Miltianthus</i> (Bge.) Boriss.	158	121
Subgenus 2. <i>Fabago</i> (Adans.) M. Pop. ...	158	122

Subgenus 3. <i>Sarcozygium</i> (Bge.) Boriss.	184	141
Subgenus 4. <i>Dumosa</i> (M. Pop.) Boriss. ...	188	144
Subgenus 5. <i>Halimiphyllum</i> (Engl.) Boriss.	189	145
Subgenus 6. <i>Pseudococcus</i> Boriss.	193	148
Genus 841. <i>Tribulus</i> L.	194	149
Subfamily 4. Nitrarioideae Engl.	196	150
Genus 842. <i>Nitraria</i> L.	196	150
Family LXXXIII. Rutaceae Juss.	198	152
Key to Genera	198	152
Subfamily 1. Rutoideae Engl.	199	153
Genus 843. <i>Ruta</i> L.	199	153
Genus 844. <i>Haplophyllum</i> A. Juss.	200	154
Genus 845. <i>Dictamnus</i> L.	227	174
Subfamily 2. Toddalioidae Engl.	232	178
Genus 846. <i>Phellodendron</i> Rupr.	232	178
Genus 846a. <i>Skimmia</i> Thunb.	233	179
Genus ★ <i>Ptelea</i> L.	233	179
Subfamily 3. Aurantioideae Engl.	233	179
Genus ★ <i>Poncirus</i> Raf.	234	179
Genus ★ <i>Citrus</i> L.	234	180
Genus ★ <i>Fortunella</i> Swing.	238	184
Family LXXXIV. Simarubaceae Lindl.	241	184
Genus ★ <i>Ailanthus</i> Desf.	241	185
Family ★ Meliaceae Vent.	244	186
Genus ★ <i>Melia</i> L.	244	187
Family LXXXV. Polygalaceae Lindl.	246	188
Genus 847. <i>Polygala</i> L.	246	188
Family LXXXVI. Euphorbiaceae J. St.-Hil.	266	204
Key to Genera	267	205
Subfamily 1. Phyllanthoideae Pax	268	206
Tribe 1. Phyllanthae Pax	268	206
Subtribe 1. Andrachninae Pax	268	206
Genus 848. <i>Arachne</i> Neck.	269	206
Genus 849. <i>Andrachne</i> L.	269	207
Subtribe 2. Phyllanthinae Pax	282	217
Genus 850. <i>Securinega</i> Comm.	282	217
Genus 851. <i>Flüggea</i> Willd.	284	218
Genus 852. <i>Phyllanthus</i> L.	287	220
Subfamily 2. Crotonoideae Pax	288	221
Tribe 1. Crotonae Pax	288	221
Subtribe 1. Chrozophorinae Pax	288	221
Genus 853. <i>Chrozophora</i> Neck.	288	221
Subtribe 2. Mercurialinae Pax	295	226
Genus 854. <i>Mercurialis</i> L.	295	226
Tribe 2. Acalypheae Pax	298	228
Genus 855. <i>Acalypha</i> L.	298	228
Genus ★ <i>Ricinus</i> L.	300	230

Tribe 3. Jathropheae Pax	302	231
Genus★ Aleurites Forst.....	303	232
Tribe 4. Euphorbieae Pax	304	233
Genus 856. Euphorbia L.....	304	233
Key to Subgenera	308	236
Subgenus 1. Paralias (Rafin.) Prokh.	308	236
Subgenus 2. Cystidospermum Prokh.	480	367
Subgenus 3. Chamaesyce	482	368
Family LXXXVII. Callitrichaceae Lindl.	495	378
Genus 857. Callitriche L.	495	378
Order 25. Sapindales Lindl.	503	384
Family LXXXVIII. Buxaceae Dumort.	503	384
Key to Genera	503	384
Genus 858. Pachysandra Mchx.	503	384
Genus 859. Buxus	504	385
Family LXXXIX. Empetraceae Lindl.	511	390
Genus 860. Empetrum L.....	511	390
Family XC. Anacardiaceae Lindl.	518	395
Tribe 1. Rhoideae Engl.....	518	396
Key to Genera	519	396
Genus 861. Pistacia L.	519	396
Genus 862. Cotinus Adans.	526	401
Genus 863. Rhus L.	527	402
Subgenus 1. Sumac (DC.) C.K. Schn.	528	403
Genus 864. Toxicodendron Mill.....	531	406
Family XCI. Aquifoliaceae DC.	539	411
Genus 865. Ilex L.	540	412
Family XCII. Celastraceae Lindl.	546	417
Subfamily 1. Celastroideae Lois.	547	417
Key to Genera	547	417
Tribe 1. Euonymae Lois.	547	418
Genus 866. Euonymus L.	548	418
Genus 867. Kalonymus (G. Beck) Prokh.	566	432
Tribe 2. Eucelastreae Lois.	573	438
Genus 868. Celastrus L.	574	438
Family XCIII. Staphyleaceae DC.	577	441
Genus 869. Staphylea L.	578	442
Family XCIV. Aceraceae Lindl.....	580	443
Genus 870. Acer L.	580	445
Family XCV. Hippocastanaceae DC.....	622	476
Genus 871. Aesculus L.	622	476
Family Sapindaceae	623	477
Family XCVI. Balsaminaceae S.F. Gray	624	478
Genus 872. Impatiens L.	624	478

Order 26. Rhamnales Engl.	634	485
Family XCVII. Rhamnaceae R. Br.	634	486
Key to Genera	635	486
Tribe 1. Zizypheae Benth. et Hook.	635	486
Genus 873. Paliurus Mill.	635	487
Genus 874. Zizyphus Mill.	636	488
Tribe 2. Rhamneae Benth. et Hook.	638	490
Genus 875. Sageretia Brongn.	638	490
Genus 876. Frangula Mill.	641	491
Genus 877. Rhamnus L.	645	494
Family XCVIII. Vitaceae Lindl.	674	516
Key to Genera	675	516
Subfamily 1. Vitoideae Gilg	675	517
Genus 878. Vitis L.	675	517
Genus 879. Ampelopsis Mchx.	704	538
Genus 880. Parthenocissus Planch.	707	541
Genus 846a. Skimmia Thunb.	710	543
Addenda XIII (Diagnoses of New Species Mentioned in Volume XIV) ..	713	545
Index Alphabeticus	761	580
Vegetation Regions of the USSR		607
List of Abbreviations		610

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SYSTEMATIC INDEX OF SPECIES IN VOLUME XIV *

Order 24. Geraniales Lindl.

Family LXXIX. Geraniaceae J. St. Hil.

Tribe 1. Geranieae Benth.

Genus 830. *Geranium* L.

Section 1. Subacaulis Boiss.

8785. 1. *G. subcaulescens* L'Hér. 10

Section 2. Sanguinea Knuth

2. *G. sanguineum* L. 10

3. *G. dahuricum* DC. 11

4. *G. soboliferum* Kom. 12

Section 3. Columbina Koch

5. *G. columbinum* L. 12

8790. 6. *G. Schrenkianum* Trautv. 13

7. *G. dissectum* L. 14

Section 4. Sylvatica Knuth

8. *G. Renardii* Trautv. 17

9. *G. psilostemon* Ldb. 18

10. *G. gymnocaulon* DC. 18

11. *G. ibericum* Cavan. 19

12. *G. montanum* Hb. 20

13. *G. platypetalum* F. et M. 20

14. *G. Sieboldii* Maxim. 21

15. *G. erlostemon* Fisch. 22

8800. 16. *G. erianthum* DC. 23

17. *G. silvaticum* L. 24

18. *G. albiflorum* Ldb. 27

19. *G. pseudosibiricum* J. Mayer 29

20. *G. bifolium* Patr. 30

21. *G. rectum* Trautv. 30

22. *G. pratense* L. 31

23. *G. transbaicalicum* Serg. 32

24. *G. affine* Ldb. 33

25. *G. Ruprechtii* Woron. 33

8810. 26. *G. finitimum* Woron. 34

* [This index has been reproduced photographically from the Russian original.]

** [Russian page numbers appear in the left-hand margin of the text.]

	Section *Unguiculata Boiss.	
	G. macrorrhizum L.	34
	Section 5. Robertiana Boiss.	
	27. G. Robertianum L.	35
	28. G. lucidum L.	36
	Section 6. Reflexa L.	
	29. G. phaeum L.	39
	Section 7. Palustria Knuth	
	30. G. Sophiae An. Fed.	40
	31. G. palustre L.	40
	32. G. Vlassovianum Fisch.	41
	33. G. Maximoviezii Rgl.	42
	34. G. collinum Steph.	43
	35. G. saxatile Kar. et Kir.	44
8820.	36. G. Meeboldii Briquet	45
	37. G. ferganense Bobr.	45
	Section 8. Striata Knuth	
	38. G. gracile Ldb.	46
	39. G. Wilfordii Maxim.	49
	Section 9. Pyrenaica Knuth	
	40. G. albanum M. B.	49
	41. G. pallens M. B.	50
	42. G. tauricum Rupr.	50
	Section 10. Rotundifolia Gams	
	43. G. pyrenaicum Burm. f.	51
	44. G. depilatum (Somm. et Lev.) Grossh.	52
	45. G. pusillum Burm. f.	52
8830.	46. G. molle L.	55
	47. G. rotundifolium L.	56
	Section 11. Divaricata Rouy	
	48. G. divaricatum Ehrh.	57
	49. G. sibiricum L.	57
	50. G. bohemicum L.	59
	Section 12. Tuberosa Boiss.	
	51. G. tuberosum L.	60
	52. G. transversale (Kar. et Kir.) Vved.	61
	53. G. linearilobum DC.	61
	54. G. Kotschyi Boiss.	62
	55. G. Charlesii (Aitch. et Hemsl.) Vved.	62
	Genus 831. <i>Erodium</i> L'Hér.	
	Section 1. Plumosa Boiss.	
8840.	1. E. oxyrrhynchum M. B.	64
	2. E. Litvinovii Voron.	65

Section 2. *Barbata* Boiss.

	3. <i>E. tibetanum</i> Edgew.	65
	4. <i>E. Stephanianum</i> Willd.	65
	5. <i>E. tataricum</i> Willd.	66
	6. <i>E. Stevenii</i> M. B.	66
	7. <i>E. Beketovii</i> Schmalh.	67
	8. <i>E. schemachense</i> Grossh.	67
	9. <i>E. fumarioides</i> Stev.	67
	10. <i>E. anthemidifolium</i> M. B.	68
8850.	11. <i>E. armenum</i> Voron.	68
	12. <i>E. ruthenicum</i> M. B.	68
	13. <i>E. malacoides</i> (L.) Willd.	69
	14. <i>E. chium</i> (Burm. f.) Willd.	69
	15. <i>E. strigosum</i> Karel.	70
	16. <i>E. Hoefftianum</i> C. A. M.	70
	17. <i>E. ciconium</i> (L.) Ait.	71
	18. <i>E. cicutarium</i> (L.) L'Hér.	71

Genus 832. *Pelargonium* L'Hér.

	1. <i>P. Endlicherianum</i> Fenzl.	73
--	--	----

Tribe 2. *Biebersteinieae* (Endl.) Boiss.

Genus 833. *Biebersteinia* Steph.

Subgenus 1. *Eubiebersteinia* Vved.

	1. <i>B. odora</i> Steph.	74
--	-----------------------------------	----

Subgenus 2. *Achillaeophyllum* Vved.

8860.	2. <i>B. multifida</i> DC.	75
-------	------------------------------------	----

Family **LXXX. Oxalidaceae** Lindl.

Genus 834. *Oxalis* L.

Section 1. *Corniculatae* (Reiche) R. Knuth

	1. <i>O. corniculata</i> (Reiche) R. Knuth	77
	2. <i>O. stricta</i> L.	78

Section 2. *Acetosellae* (Reiche) R. Knuth

	3. <i>O. acetosella</i> L.	79
	4. <i>O. obtriangulata</i> Maxim.	81

Section 3. *Cernuae* R. Knuth

	5. <i>O. violacea</i> L.	81
	6. <i>O. pes-caprae</i> L.	82

Family★ **Tropaeolaceae** Juss.

Genus★ *Tropaeolum* L.

—	<i>T. majus</i> L.	84
—	<i>T. minus</i> L.	84

Family **LXXXI. Linaceae** Dumort.

Genus 835. *Radiola* Roth.

1. <i>R. linoides</i> Roth.	85
-------------------------------------	----

Genus 836. *Linum* L.

Section 1. *Protolinum* Planch.

1. <i>L. nervosum</i> Waldst. et Kit.	92
2. <i>L. jaiicola</i> Juz.	93
8870. 3. <i>L. angustifolium</i> Huds.	95
4. <i>L. crepitans</i> Dum.	96
5. <i>L. bienne</i> Mill.	99
6. <i>L. usitatissimum</i> L.	100
7. <i>L. humile</i> Mill.	102

Section 2. *Adenolinum* Rehb.

8. <i>L. macrorrhizum</i> Juz.	105
9. <i>L. pallescens</i> Bge.	106
10. <i>L. mesostylum</i> Juz.	107
11. <i>L. violascens</i> Bge.	108
12. <i>L. baicalense</i> Juz.	109
8880. 13. <i>L. amurense</i> Alef.	110
14. <i>L. subbiflorum</i> Juz.	110
15. <i>L. boreale</i> Juz.	111
16. <i>L. Komarovii</i> Juz.	112
17. <i>L. altaicum</i> Ldb.	113
18. <i>L. atricalyx</i> Juz.	114
19. <i>L. turcomanicum</i> Juz.	114
20. <i>L. extraaxillare</i> Kit.	115
21. <i>L. perenne</i> L.	116
22. <i>L. brevisepalum</i> Juz.	117
8890. 23. <i>L. euxinum</i> Juz.	118
24. <i>L. Marschallianum</i> Juz.	120
25. <i>L. austriacum</i> L.	123

Section 3. *Stellerolinum* Juz.

26. <i>L. stelleroides</i> Planch.	125
--	-----

Section 4. *Dichrolinum* Planch.

27. <i>L. tenuifolium</i> L.	125
--------------------------------------	-----

Section 5. *Cathartolinum* Rehb.

28. <i>L. catharticum</i> L.	127
--------------------------------------	-----

Section 6. *Linopsis* Rehb.

29. <i>L. corymbulosum</i> Rehb.	128
30. <i>L. gallicum</i> L.	129

Section 7. *Limoniopsis* Planch.

31. <i>L. orientale</i> Boiss.	130
32. <i>L. tauricum</i> Willd.	131
8900. 33. <i>L. Pallasianum</i> Schult.	132
34. <i>L. linearifolium</i> Jávorka	133

35. <i>L. basarabicum</i> (Savul. et Rayss) Klok.	133
36. <i>L. ucranicum</i> Czern.	134
37. <i>L. Czerniaëvii</i> Klok.	135
38. <i>L. uralense</i> Juz.	135
39. <i>L. flavum</i> L.	136
40. <i>L. luteolum</i> M. B.	139

Section 8. *Dasylinum* Planch.

41. <i>L. hypericifolium</i> Salisb.	140
42. <i>L. hirsutum</i> L.	141
910. 43. <i>L. lanuginosum</i> Juz.	143

Section 9. *Macrantholinum* Juz.

44. <i>L. heterosepalum</i> Rgl.	144
45. <i>L. Olgae</i> Juz.	145

Family LXXXII. *Zygophyllaceae* Lindl.

Subfamily 1. *Peganoideae* Engl.

Genus 837. *Peganum* L.

1. <i>P. harmala</i> L.	148
2. <i>P. nigellastrum</i> Bge.	149

Genus 838. *Malacocarpus* Fisch. et Mey.

1. <i>M. erithmifolius</i> (Retz.) C. A. M.	150
---	-----

Subfamily 2. *Tetradiclidoidae* Engl.

Genus 839. *Tetradiclis* Stev.

1. <i>T. tenella</i> (Ehrenb.) Litw.	151
--	-----

Subgenus 3. *Zygophylloideae* Engl.

Genus 840. *Zygophyllum* L.

Subgenus 1. *Miltianthus* (Bge.) Boriss.

1. <i>Z. portulacoides</i> Cham.	158
--	-----

Subgenus 2. *Fabago* (Adans.) M. Pop.

Section 1. *Eufabago* M. Pop.

2. <i>Z. fabago</i> L.	159
3. <i>Z. oxianum</i> Boriss.	160
8920. 4. <i>Z. macropodium</i> Boriss.	161
5. <i>Z. obliquum</i> M. Pop.	162
6. <i>Z. brachypterum</i> Kar. et Kir.	165
7. <i>Z. miniatum</i> Cham. et Schlecht.	166
8. <i>Z. Rosovli</i> Bge.	167
9. <i>Z. latifolium</i> Schrenk	167
10. <i>Z. microcarpum</i> Boriss.	168
11. <i>Z. turcomanicum</i> Fisch. et Me	168
12. <i>Z. Dielsianum</i> M. Pop.	169
13. <i>Z. subtrijugum</i> C. A. M.	170

8930.	14. <i>Z. balchashense</i> Boriss.	171
	15. <i>Z. furcatum</i> C. A. M.	172
Section 2. <i>Pterocarpium</i> Boriss.		
	16. <i>Z. oxyeapum</i> M. Pop.	172
	17. <i>Z. kopalense</i> Boriss.	173
	18. <i>Z. cuspidatum</i> Boriss.	174
	19. <i>Z. karatavicum</i> Boriss.	174
	20. <i>Z. Lehmannianum</i> Bge.	175
	21. <i>Z. iliense</i> M. Pop.	176
	22. <i>Z. pterocarpum</i> Bge.	177
	23. <i>Z. taldy-kurganicum</i> Boriss.	177
8940.	24. <i>Z. fabagoides</i> M. Pop.	178
	25. <i>Z. Eichwaldii</i> C. A. M.	179
	26. <i>Z. ovigerum</i> Fisch. et Mey.	180
	27. <i>Z. stenopterum</i> Schrenk	181
	28. <i>Z. kegensense</i> Boriss.	181
	29. <i>Z. macropterum</i> C. A. M.	182
	30. <i>Z. Potaninii</i> Maxim.	183
Subgenus 3. <i>Sarcozygium</i> (Bge.) Boriss.		
Section 1. <i>Xanthoxylon</i> (Bge.) Boriss.		
	31. <i>Z. ferganense</i> (Drob.) Boriss.	184
	32. <i>Z. kaschgaricum</i> Boriss.	187
Subgenus 4. <i>Dumosa</i> Boriss.		
	33. <i>Z. bucharicum</i> B. Fedtsch.	188
Subgenus 5. <i>Halimiphyllum</i> (Engl.) Boriss.		
8950.	34. <i>Z. eurypterum</i> Boiss. et Buhse	189
	35. <i>Z. Gontscharovii</i> Boriss.	190
	36. <i>Z. darvasicum</i> Boriss.	190
	37. <i>Z. atriplicoides</i> Fisch.	191
	38. <i>Z. megacarpum</i> Boriss.	192
Subgenus 6. <i>Pseudococcus</i> Boriss.		
	39. <i>Z. melongena</i> Bge.	193
Genus 841. <i>Tribulus</i> L.		
	1. <i>T. macropterus</i> Boiss.	194
	2. <i>T. terrestris</i> J.	195
Subfamily 4. <i>Nitrarioideae</i> Engl.		
Genus 842. <i>Nitraria</i> L.		
	1. <i>N. sibirica</i> Pall.	197
	2. <i>N. Schoberi</i> L.	197
8960.	3. <i>N. Komarovii</i> Iljin et Lava	198
Family LXXXIII Rutaceae Juss.		
Genus 843. <i>Ruta</i> L.		
	1. <i>R. graveolens</i> L.	199

Genus 844. *Haplophyllum* A. Juss.

Section 1. *Peganoides* (L.) G. Don

1. *H. dauricum* (L.) G. Don. 205

Section 2. *Polyoon* Vved.

2. *H. pedicellatum* Bge. 206
 3. *H. suaveolens* (DC.) G. Don 207
 4. *H. ciliatum* Gris. 208
 5. *H. Bourgaei* Boiss. 211
 6. *H. bucharicum* Litv. 211
 7. *H. affine* (Aitch. et Hemsl.) Eug. Kor. 212

Section 3. *Oligoon* Vved.

8. *H. Kowalenskyi* Stschegl. 212
 8970. 9. *H. Eugenii* Korovinii Pavl. 213
 10. *H. multicaule* Vved. 213
 11. *H. ramosissimum* Vved. 214
 12. *H. obtusifolium* Ldb. 214
 13. *H. monadelphum* C. Afan. 215
 14. *H. dshungaricum* Rubtz. 215
 15. *H. foliosum* Vved. 216
 16. *H. tenuisectum* Linz. 216
 17. *H. leptomerum* Linz. 217
 18. *H. tenue* Boiss. 217
 8980. 19. *H. ciscaucasicum* Grossh. 218
 20. *H. villosum* (M. B.) G. Don 218
 21. *H. Schelkovnikovii* Grossh. 219
 22. *H. dubium* Eug. Kor. 220
 23. *H. Vvedenskyi* Nevski 220
 24. *H. Alberti* Regelii Eug. Kor. 221
 25. *H. Bungei* Trautv. 222
 26. *H. Popovii* Eug. Kor. 222
 27. *H. robustum* Bge. 223
 28. *H. ferganicum* Vved. 223
 8990. 29. *H. versicolor* Fisch. et Mey. 224

Section 4. *Achaenococcum* Vved.

30. *H. latifolium* Kar. et Kir. 225
 31. *H. acutifolium* (DC.) G. Don 226
 32. *H. perforatum* (M. B.) Kar. et Kir. 226

Genus 845. *Dictamnus* L.

1. *D. dasycarpus* Turcz. 229
 2. *D. tadshikorum* Vved. 229
 3. *D. angustifolius* G. Don 230
 4. *D. caucasicus* Fisch. 231
 5. *D. gymnostylis* Stev. 231

Genus 846. *Phellodendron* Rupr.

1. *Ph. amurense* Rupr. 232

	Genus 846a. <i>Skimmia</i> Thunb.	
1.	<i>S. repens</i> Nakai	710
	Genus ★ <i>Ptelea</i> L.	
1.	<i>P. trifoliata</i> L.	233
	Genus ★ <i>Poncirus</i> Raf.	
—	1. <i>P. trifoliata</i> (L.) Raf.	234
	Genus ★ <i>Citrus</i> L.	
—	1. <i>C. limon</i> Burm.	237
—	2. <i>C. unshiu</i> Marc.	237
	Genus ★ <i>Fortunella</i> Swing.	
—	1. <i>F. japonica</i> (Thunb.) Swing.	241
	Family LXXXIV. <i>Simarubaceae</i> Lindl.	
	Genus ★ <i>Ailanthus</i> Desf.	
—	— <i>A. altissima</i> (Mill.) Swing.	242
	Family ★ <i>Melicaceae</i> Vent	
	Genus ★ <i>Melia</i> L.	
—	<i>M. azedarach</i>	244
	Family LXXXV. <i>Polygalaceae</i> Lindl.	
	Genus 847. <i>Polygala</i> L.	
	Section 1. <i>Migratoria</i> Tamamsch.	
9000.	1. <i>P. sibirica</i> L.	250
	2. <i>P. tenuifolia</i> Willd.	251
	3. <i>P. japonica</i> Houttuyn	252
	Section 2. <i>Polygalon</i> DC.	
	4. <i>P. papilionacea</i> Boiss.	253
	5. <i>P. Hohenackeriana</i> Fisch. et Mey.	
	6. <i>P. Stocksiana</i> Boiss.	254
	7. <i>P. supina</i> Schreb.	254
	8. <i>P. andrachnoides</i> Willd.	255
	9. <i>P. pseudohospita</i> Tamamsch.	255
	10. <i>P. pruinosa</i> Boiss.	256
9010.	11. <i>P. austriaca</i> Crantz	256
	12. <i>P. subamara</i> Fritsch	257
	13. <i>P. amarella</i> Crantz	257
	14. <i>P. suanica</i> Tamamsch.	258
	15. <i>P. alpicola</i> Rupr.	258
	16. <i>P. caucasica</i> Rupr.	259
	17. <i>P. vulgaris</i> L.	259
	18. <i>P. hybrida</i> DC.	260
	19. <i>P. comosa</i> Schkuhr	261
	20. <i>P. moldavica</i> Kotov	261
9020.	21. <i>P. amoenissima</i> Tamamsch.	262
	22. <i>P. cretacea</i> Kotov	262

23. <i>P. major</i> Jacq.	262
24. <i>P. colchica</i> Tamamsch.	263
25. <i>P. Mariamae</i> Tamamsch.	263
26. <i>P. leucothyrsa</i> Voron.	264
27. <i>P. Urartu</i> Tamamsch.	264
28. <i>P. Kemulariae</i> Tamamsch.	265
29. <i>P. transcaucasica</i> Tamamsch.	265
30. <i>P. anatolica</i> Boiss.	265

Family **LXXXVI. Euphorbiaceae** J. St. Hil.

Subfamily 1. **Phyllanthoideae** Pax

Tribe 1 *Phyllanthae* Pax

Subtribe 1. *Andrachninae* Pax

Genus 848. *Arachne* Neck.

9030. 1. <i>A. colchica</i> (Fisch. et Mey.) Pojark.	269
--	-----

Genus 849. *Andrachne* L.

Section 1. *Telephioideae* (Mönch) Endl.

1. <i>A. telephoides</i> L.	272
2. <i>A. rotundifolia</i> C. A. M.	272
3. <i>A. virga-tenuis</i> Nevski	274

Section 2. *Fruticulosae* Pojark.

4. <i>A. Buschiana</i> Pojark.	277
5. <i>A. pusilla</i> Pojark.	278
6. <i>A. pygmaea</i> Koss.	279
7. <i>A. stenophylla</i> Koss.	279
8. <i>A. filiformis</i> Pojark.	280
9. <i>A. Fedtshenkoi</i> Koss.	281

Genus 850. *Securinea* Comm.

9040. 1. <i>S. suffruticosa</i> (Pall.) Rehd.	283
---	-----

Genus 851. *Fluggea* Willd.

1. <i>F. ussuriensis</i> Pojark.	284
--	-----

Genus 852. *Phyllanthus* L.

1. <i>Ph. ussuriensis</i> Rupr. et Maxim.	287
---	-----

Subfamily 2. **Crotonoideae** Pax

Tribe 1. *Crotoneae* Pax

Subtribe 1. *Chrozophorinae* Pax

Genus 853. *Chrozophora* Neck.

Section 1. *Trichocarpa* Prain

1. <i>C. sabulosa</i> Kar. et Kir	289
2. <i>C. gracilis</i> Fisch. et Mey.	299

	Section 2. <i>Lepidocarpa</i> Prain	
	3. <i>C. tinctoria</i> A. Juss.	290
	4. <i>C. hierosolymitana</i> Spreng	291
	5. <i>C. obliqua</i> (Vahl) A. Juss.	292
	Subtribe 2. <i>Mercurialinae</i> Pax	
	Genus 854. <i>Mercurialis</i>	
	1. <i>M. perennis</i> L.	296
	2. <i>M. ovata</i> Sternb. et Hoppe	297
9050.	3. <i>M. annua</i> L.	298
	Tribe 2. <i>Acalyphaeae</i> Pax	
	Genus 855. <i>Acalypha</i> L.	
	1. <i>A. australis</i> L.	299
	2. <i>A. indica</i> L.	299
	Genus * <i>Ricinus</i> L.	
—	— <i>R. communis</i> L.	300
	Genus * <i>Aleurites</i> Forst.	
—	— <i>A. Fordii</i> Hemsl.	303
	Tribe 2. <i>Euphorbieae</i> Pax	
	Genus 856. <i>Euphorbia</i> L.	
	Subgenus 1. <i>Paralias</i> (Rafin.) Prokh.	
	Section 1. <i>Sclerocyathium</i> Prokh.	
	1. <i>E. sclerocyathium</i> E. Kor. et M. Pop.	336
	Section 2. <i>Holophyllum</i> Prokh.	
	2. <i>E. serawschanica</i> Rgl.	338
	3. <i>E. monocyathium</i> Prokh.	338
	4. <i>E. rosularis</i> A. Theod.	339
	5. <i>E. tianschanica</i> Prokh.	339
	6. <i>E. Prokhanovii</i> M. Pop.	340
	7. <i>E. rupestris</i> C. A. M.	341
9060.	8. <i>E. mongolica</i> Prokh.	342
	9. <i>E. Pallasii</i> Turcz.	343
	10. <i>E. Komaroviana</i> Prokh.	343
	11. <i>E. rapulum</i> Kar. et Kir.	344
	12. <i>E. blepharophylla</i> C. A. M.	345
	13. <i>E. ferganensis</i> B. Fedtsch.	346
	14. <i>E. Lipskyi</i> Prokh.	347
	Section 3. <i>Tulocarpa</i> (Rafin.) Prokh.	
	15. <i>E. scripta</i> Somm. et Lev.	348
	16. <i>E. squamosa</i> Willd.	349
	17. <i>E. macrocarpa</i> Boiss. et Buhse	350
9070.	18. <i>E. transoxana</i> Prokh.	350
	19. <i>E. mucronulata</i> Prokh.	351

	20. <i>E. Kudriaschevii</i> (Pazlj) Prokh.	352
	21. <i>E. orientalis</i> L.	352
	22. <i>E. palustris</i> L.	355
	23. <i>E. Eugeniae</i> Prokh.	356
	24. <i>E. carpatica</i> Woloszcz.	357
	25. <i>E. tauricola</i> Prokh.	358
	26. <i>E. villosa</i> Waldst. et Kit.	359
9080.	27. <i>E. semivillosa</i> Prokh.	360
	28. <i>E. aristata</i> Schmalh.	361
	29. <i>E. songarica</i> Boiss.	362
	30. <i>E. lamprocarpa</i> Prokh.	362
	31. <i>E. pilosa</i> L.	363
	32. <i>E. polychroma</i> Kern.	364
	33. <i>E. carniolica</i> Jacq.	365
	34. <i>E. stricta</i> L.	366
	35. <i>E. platyphylla</i> L.	367
	36. <i>E. microsperma</i> Boiss.	368
	37. <i>E. coniosperma</i> Boiss. et Buhse	369
9090.	38. <i>E. alpina</i> C. A. M.	370
	39. <i>E. macrorrhiza</i> C. A. M.	371
	40. <i>E. buchtormensis</i> C. A. M.	371
	41. <i>E. pubescens</i> Vahl	372
	42. <i>E. alata</i> Boiss.	373
	43. <i>E. lucorum</i> Rupr.	374
	44. <i>E. condylocarpa</i> M. B.	377
	45. <i>E. Wittmanni</i> Boiss.	377
	46. <i>E. pachyrrhiza</i> Kar. et Kir.	378
	47. <i>E. talastavica</i> Prokh.	379
9100.	48. <i>E. dulcis</i> L.	379
	49. <i>E. angulata</i> Jacq.	381
	50. <i>E. altaica</i> C. A. M.	381
	51. <i>E. eriophora</i> Boiss.	382
	52. <i>E. helioscopia</i> L.	383

Section 4. *Chylogala* Prokh.

	53. <i>E. tibetica</i> Boiss.	385
	54. <i>E. Tranzschelii</i> Prokh.	386
	55. <i>E. Bungei</i> Boiss.	386
	56. <i>E. schugnanica</i> B. Fedtsch.	387
	57. <i>E. turkestanica</i> Rgl.	388
9110.	58. <i>E. alata</i> Prokh.	388
	59. <i>E. ispanica</i> Boiss.	390
	60. <i>E. Grossheimii</i> Prokh.	391

Section 5. *Murtekias* (Raf.) Prokh.

	61. <i>E. paralias</i> L.	391
	62. <i>E. petrophila</i> C. A. M.	392
	63. <i>E. Seguieriana</i> Neck.	395
	64. <i>E. humilis</i> C. A. M.	397
	65. <i>E. kopetdaghi</i> Prokh.	398
	66. <i>E. sogdiana</i> M. Pop.	399
	67. <i>E. macroclada</i> Boiss.	400
9120.	68. <i>E. stepposa</i> Zoz.	401

	69. <i>E. glareosa</i> Pall.	402
	70. <i>E. volgensis</i> Krysht.	403
	71. <i>E. Goldei</i> Prokh.	404
	72. <i>E. biglandulosa</i> Desf.	405
	73. <i>E. monostyla</i> Prokh.	406
	74. <i>E. spinidens</i> Bornm.	407
	75. <i>E. myrsinites</i> L.	408
	76. <i>E. pontica</i> Prokh.	408
	77. <i>E. Woronowii</i> Grossh.	409
9130.	78. <i>E. Marschalliana</i> Boiss.	410
	79. <i>E. armena</i> Prokh.	411
	80. <i>E. denticulata</i> Lam.	412
Section 6. <i>Esula</i> Prokh.		
	81. <i>E. Buschiana</i> Grossh.	413
	82. <i>E. undulata</i> M. B.	414
	83. <i>E. irgisensis</i> Litw.	417
	84. <i>E. andrachnoides</i> Schrenk	418
	85. <i>E. Buhsei</i> Boiss.	419
	86. <i>E. esula</i> L.	419
	87. <i>E. microcarpa</i> Prokh.	420
9140.	88. <i>E. subtilis</i> Prokh.	421
	89. <i>E. Gmelini</i> Steud.	422
	90. <i>E. discolor</i> Ldb.	423
	91. <i>E. Karoi</i> Freyn	424
	92. <i>E. Borszczowii</i> Prokh.	425
	93. <i>E. sareptana</i> Beck.	425
	94. <i>E. latifolia</i> C. A. M.	426
	95. <i>E. Borodini</i> Sambuk	427
	96. <i>E. poecilophylla</i> Prokh.	428
	97. <i>E. salicifolia</i> Host	429
9150.	98. <i>E. glomerulans</i> Prokh.	429
	99. <i>E. agraria</i> M. B.	430
	100. <i>E. Sewerzowii</i> Herd.	433
	101. <i>E. mandshurica</i> Maxim.	433
	102. <i>E. lucida</i> Waldst. et Kit.	434
	103. <i>E. iberica</i> Boiss.	435
	104. <i>E. pseudagraria</i> P. Smirn.	436
	105. <i>E. uralensis</i> Fisch.	437
	106. <i>E. pamirica</i> Prokh.	438
	107. <i>E. cyparissias</i> L.	439
9160.	108. <i>E. astrachanica</i> C. A. M.	440
	109. <i>E. tshuiensis</i> (Prokh.) Serg.	440
	110. <i>E. cyrtophylla</i> Prokh.	441
	111. <i>E. guntensis</i> Prokh.	442
	112. <i>E. leptocaula</i> Boiss.	443
	113. <i>E. virgata</i> Waldst. et Kit.	443
	114. <i>E. Boissieriana</i> (Woron.) Prokh.	446
	115. <i>E. jaxartica</i> Prokh.	446
	116. <i>E. zhigulensis</i> Prokh.	447
	117. <i>E. subcordata</i> C. A. M.	448
9170.	118. <i>E. Sieboldiana</i> Morr. et Decne.	451
	119. <i>E. Savaryi</i> Kiss.	452

120. <i>E. amygdaloides</i> L.	453
121. <i>E. glaberrima</i> C. Koch	454
122. <i>E. oblongifolia</i> C. Koch	455
123. <i>E. macroceras</i> Fisch. et Mey.	455

Section 7. *Herpetorrhiza* Prokh.

124. <i>E. Aucheri</i> Boiss.	456
125. <i>E. deltobracteata</i> Prokh.	457
126. <i>E. polytimetica</i> Prokh.	458

Section 8. *Cymatospermum* Prokh.

127. <i>E. aleppica</i> L.	460
9180. 128. <i>E. exigua</i> L.	460
129. <i>E. graeca</i> Boiss. et Sprun.	461
130. <i>E. Ledebourii</i> Boiss.	462
131. <i>E. peplus</i> L.	463
132. <i>E. aulacosperma</i> Boiss.	464
133. <i>E. falcata</i> L.	464
134. <i>E. acuminata</i> Lam.	465
135. <i>E. Normanni</i> Schmalh.	466
136. <i>E. Francheti</i> B. Fedtsch.	467
137. <i>E. inderiensis</i> Less.	468
9190. 138. <i>E. triodonta</i> Prokh.	469
139. <i>E. sororia</i> Schrenk	470
140. <i>E. aserbaidzhanica</i> Bordz.	470
141. <i>E. consanguinea</i> Schrenk	471
142. <i>E. Turczaninowii</i> Kar. et Kir.	472
143. <i>E. arvalis</i> Boiss. et Heldr.	472
144. <i>E. densa</i> Schrenk	473
145. <i>E. Szovitsii</i> Fisch. et Mey.	474
146. <i>E. densiuscula</i> M. Pop.	475

Section 9. *Demetra* (Rafin.) Prokh.

147. <i>E. lanata</i> Sieber	475
--	-----

Section 10. *Epurga* Prokh.

9200. 148. <i>E. lathyris</i> L.	479
--	-----

Subgenus 2. *Cystidospermum* Prokh.

149. <i>E. cheirolepis</i> Fisch. et Mey.	481
---	-----

Subgenus 3. *Chamaesyce* (S. F. Gray) L. C. Wheler.

150. <i>E. nutans</i> Lagasca	485
151. <i>E. indica</i> Lam.	486
152. <i>E. pepitis</i> L.	486
153. <i>E. humifusa</i> Willd.	487
154. <i>E. chamaesyce</i> L.	488
155. <i>E. canescens</i> L.	491
156. <i>E. turcomanica</i> Boiss.	492
157. <i>E. anisopetala</i> Prokh.	492
9210. 158. <i>E. Forskalii</i> J. Gay	493
159. <i>E. maculata</i> L.	494

Family **LXXXVII. Callitrichaceae** Lindl.

Genus 857. *Callitriche* L.

Section 1. *Eucalitriche* Hegelm.

1. <i>C. verna</i> L.	496
2. <i>C. elegans</i> V. Petr.	497
3. <i>C. fallax</i> V. Petr.	498
4. <i>C. polymorpha</i> Loener.	498
5. <i>C. subanceps</i> V. Petr.	501
6. <i>C. stagnalis</i> Scop.	501
7. <i>C. pedunculata</i> DC.	502

Section 2. *Pseudocallitriche* Hegelm.

8. <i>C. autumnalis</i> L.	502
------------------------------------	-----

Order 25. **Sapindales** Lindl.

Family **LXXXVIII. Buxaceae** Dumort.

Genus 858. *Pachysandra* Mchx.

9220. 1. <i>P. terminalis</i> S. et Z.	504
--	-----

Genus 859. *Buxus* L.

1. <i>B. colchica</i> Pojark.	505
2. <i>B. hyrcana</i> Pojark.	509
— <i>B. sempervirens</i> L.	509

Genus 860. *Empetrum* L.

Section 1. *Neo-Empetrum* V. Vassil.

1. <i>E. nigrum</i> L.	512
2. <i>E. sibiricum</i> V. Vassil.	513
3. <i>E. kurilense</i> V. Vassil.	514
4. <i>E. hermaphroditum</i> (Lge.) Hagerup	515
5. <i>E. androgynum</i> V. Vassil.	515
6. <i>E. arcticum</i> V. Vassil.	516

Section 2. *Palaeo-Empetrum* V. Vassil.

7. <i>E. Kadrakovii</i> V. Vassil.	517
--	-----

Family **XC. Anacardiaceae** Lindl.

Tribe 1. *Rhoideae* Engl.

Genus 861. *Pistacia* L.

9230. 1. <i>P. vera</i> L.	520
2. <i>P. mutica</i> F. et M.	524

Genus 862. *Cotinus* Adans.

1. <i>C. coggiria</i> Scop.	526
-------------------------------------	-----

Genus 863. *Rhus* L.

Subgenus 1. *Sumac* (DC.) C. K. Schn.

1. <i>R. coriaria</i> L.	528
— <i>R. hirta</i> (L.) Sudw.	530
— <i>R. javanica</i> L.	531

Genus 864. *Toxicodendron* Mill.

Section 1. *Eutoxicodendron* C. K. Schn.

1. <i>T. orientale</i> Greene	535
— <i>T. radicans</i> (L.) Ktze.	535

Section 2. *Vernix* (Adans.) C. K. Schn.

— <i>T. vernicifluum</i> (Stokes) Linz.	537
2. <i>T. trichocarpum</i> (Miq.) Ktze.	538
— <i>T. vernix</i> (L.) Ktze.	538

Family XCI. *Aquifoliaceae* DC.

Genus 865. *Ilex* L.

— 1. <i>i. aquifolium</i> L.	541
1. <i>I. colchica</i> Pojark.	542
2. <i>I. stenocarpa</i> Pojark.	543
3. <i>I. hyrcana</i> Pojark.	544
4. <i>I. crenata</i> Thunbg.	544
9240. 5. <i>I. rugosa</i> Fr. Schmidt.	545

Family XCII. *Celastraceae* Lindl.

Subfamily 1. *Celastroideae* Lois.

Tribe 1. *Euonymae* Lois.

Genus 866. *Euonymus* L.

Section 1. *Ilicifolius* Nakai

— <i>E. japonica</i> L. f.	552
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Section 2. *Pragmotessara* (Pierre) Nakai

1. <i>E. europaea</i> L.	553
2. <i>E. Maackii</i> Rupr.	555
3. <i>E. Sieboldiana</i> Blume	556
4. <i>E. velutina</i> (C. A. M.) Fisch. et Mey.	557

Section 3. *Melanocarya* (Turcz.) Nakai

5. <i>E. sacrosancta</i> Koidz.	557
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Section 4. *Kalonymopsis* Prokh.

6. <i>E. Semenovii</i> Rgl. et Herd.	559
7. <i>E. verrucosa</i> Scop.	559
8. <i>E. pauciflora</i> Maxim.	560

	9. <i>E. nana</i> M. B.	561
9250.	10. <i>E. Koopmanni</i> Lauche	565

Genus 867. *Kalonymus* (G. Beck) Prokh.

	1. <i>K. yezoensis</i> (Koidz.) Prokh.	568
	2. <i>K. latifolia</i> (Mill.) Prokh.	569
	3. <i>K. Maximowicziana</i> Prokh.	570
	4. <i>K. sachalinensis</i> (F. Schmidt) Prokh.	571
	5. <i>K. leiophloea</i> (Stev.) Prokh.	572
	6. <i>K. macroptera</i> (Rupr.) Prokh.	573

Tribe 2. *Eucelestraceae* Lois.

Genus 868. *Celastrus* L.

	1. <i>C. orbiculata</i> L.	575
	2. <i>C. strigillosus</i> Nakai	576
	3. <i>C. flagellaris</i> Rupr.	576

Family **XCIII. Staphyleaceae** DC.

Genus 869. *Staphylea* L.

9260.	1. <i>S. colchica</i> Stev.	578
	2. <i>S. pinnata</i> L.	579

Family **XCIV. Aceraceae** Lindl

Genus 870. *Acer* L.

Section 1. *Platanoides* Pax

	1. <i>A. pictum</i> Thunb.	589
	2. <i>A. mono</i> Maxim.	590
	3. <i>A. turkestanicum</i> Pax	590
	4. <i>A. laetum</i> C. A. M.	591
	5. <i>A. platanoides</i> L.	592
	6. <i>A. divergens</i> C. Koch	593
	7. <i>A. pubescens</i> Franch.	594
	8. <i>A. Regelii</i> Pax	595
9270.	9. <i>A. campestre</i> L.	596

Section 2. *Gemmata* Pojark.

	10. <i>A. velutinum</i> Boiss.	597
	11. <i>A. pseudoplatanus</i> L.	598
	12. <i>A. Trautvetteri</i> Medw.	600

Section 3. *Trilobata* Pojark.

	13. <i>A. ginnala</i> Maxim.	601
	14. <i>A. Semenovii</i> Rgl. et Herd.	602
	15. <i>A. tataricum</i> L.	603

Section 4. *Microcarpa* Pojark.

	16. <i>A. ukurunduense</i> Trautv.	607
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	Section 5. <i>Palmata</i> Pax	
9280.	17. <i>A. pseudosieboldianum</i> (Pax) Kom.	608
	Section 6. <i>Macrantha</i> Pax	
	18. <i>A. tegmentosum</i> Maxim.	609
—	— <i>A. pennsylvanicum</i> L.	610
9280.	19. <i>A. Komarovii</i> Pojark.	611
	Section 7. <i>Sacharina</i> Pax	
—	— <i>A. saccharum</i> Marsh.	612
	Section 8. <i>Goniocarpa</i> Pojark.	
	20. <i>A. hyrcanum</i> Fisch. et Mey.	613
	21. <i>A. Stevenii</i> A. Pojark.	614
	22. <i>A. ibericum</i> M. B.	615
	23. <i>A. turcomanicum</i> Pojark.	616
	Section 9. <i>Trifoliata</i> (Pax) Koldz.	
	24. <i>A. mandschuricum</i> Maxim.	617
	Section 10. <i>Arguta</i> Rehd.	
	25. <i>A. barbinerve</i> Maxim.	618
	Section 11. <i>Rubra</i> Pax	
—	— <i>A. rubrum</i> L.	619
—	— <i>A. saccharinum</i> L.	620
	Section 12. <i>Negundo</i> (Ludw.) C. Koch.	
—	— <i>A. negundo</i> L.	621
	Family XCV. <i>Hippocastanaceae</i> DC.	
	Genus 871. <i>Aesculus</i> L.	
	1. <i>A. hippocastanum</i> L.	622
	Family * <i>Sapindaceae</i>	
	Family XCVI. <i>Balsaminaceae</i> S. F. Gray	
	Genus 872. <i>Impatiens</i> L.	
	Section 1. <i>Brachycentron</i> Warb.	
	1. <i>I. noli-tangere</i> L.	626
	2. <i>I. Maackii</i> Hook.	627
9290	3. <i>I. furcillata</i> Hemsley	627
	4. <i>I. Textori</i> Miq.	628
	5. <i>I. Komarovii</i> Pob.	631
	6. <i>I. parviflora</i> DC.	631
	7. <i>I. brachycentra</i> Kar. et Kir.	632
	8. <i>I. Nevskii</i> Pob.	632

	Section 2. <i>Microcentron</i> Warb.	633
	9. <i>I. balsamina</i> L.	633
	Section 3. <i>Salpiglochilon</i> Warb.	
	10. <i>I. Roylei</i> Walp.	633
	Order 26. <i>Rhamnales</i> R. Br.	
	Family XCVII. Rhamnaceae R. Br.	
	Tribe 1. <i>Zizipheae</i> Benth. et Hook.	
	Genus 873. <i>Palturus</i> Mill.	
	1. <i>P. spina</i> Christi Miller	636
	Genus 874. <i>Zizyphus</i> Mill.	
	1. <i>Z. jujuba</i> Mill.	637
	Genus 875. <i>Sageretia</i> Brongn.	
9300.	1. <i>S. laetevirens</i> (Kom.) Gontsch.	638
	Genus 876. <i>Frangula</i> Mill.	
	Section 1. <i>Eufrangula</i> Grub.	
	1. <i>F. alnus</i> Miller	642
	Section 2. <i>Cascara</i> Grub.	
	2. <i>F. grandifolia</i> (Fisch. et Mey.) Grub.	643
	3. <i>F. rupestris</i> (Scop.) Schur.	644
	Genus 877. <i>Rhamnus</i> L.	
	Section 1. <i>Alaternus</i> DC.	
	1. <i>R. alaternus</i> L.	653
	Section 2. <i>Eurhamnus</i> Boiss.	
	2. <i>R. imeretina</i> Booth	654
	3. <i>R. microcarpa</i> Boiss.	655
	4. <i>R. depressa</i> Grub.	655
	Section <i>Cervispina</i> DC.	
	5. <i>R. dahurica</i> Pall.	656
	6. <i>R. ussuriensis</i> J. Vass.	659
9310.	7. <i>R. cathartica</i> L.	660
	8. <i>R. diamantiaca</i> Nakai	662
	9. <i>R. parvifolia</i> Bge.	663
	10. <i>R. dolichophylla</i> N. Gontsch.	664
	11. <i>R. tinctoria</i> Waldst.	
	12. <i>R. erythroxyton</i> Pall.	666
	13. <i>R. Pallastii</i> Fisch. et Mey.	669
	14. <i>R. spathulifolia</i> Fisch. et Mey.	670
	15. <i>R. Sintenisii</i> Rech. f.	671
	16. <i>R. baldschuanica</i> Grub.	672

9320.	17. <i>R. minuta</i> Grub.	673
	18. <i>R. songorica</i> N. Gontsch.	673
	Family XCVIII. Vitaceae Lindl.	674
	Subfamily <i>Vitoideae</i> Gilg	675
	Genus 878. <i>Vitis</i> L.	
	1. <i>V. labrusca</i> L.	678
	2. <i>V. Thunbergii</i> Sieb. et Zucc.	680
—	— <i>V. Berlandieri</i> Planch.	683
—	— <i>V. rupestris</i> Scheele	684
—	— <i>V. vulpina</i> L.	685
	3. <i>V. vinifera</i> L.	686
	4. <i>V. silvestris</i> Gmel.	697
	5. <i>V. amurensis</i> Rupr.	700
	Genus 879. <i>Ampelopsis</i> Mehx.	
	1. <i>A. vitifolia</i> (Boiss.) Planch.	705
	2. <i>A. brevipedunculata</i> (Maxim.) Trautv.	705
	3. <i>A. heterophylla</i> (Thnb.) Sieb. et Zucc.	706
9330.	4. <i>A. japonica</i> (Thnb.) Makino	706
	Genus 880. <i>Parthenocissus</i> Planch.	
	Section 1. <i>Palaeocissus</i> Koehne	
9331.	1. <i>P. tricuspidata</i> (Sieb. et Zucc.) Planch.	708
	Section 2. <i>Earinocissus</i> Graebn.	
—	2. <i>P. inserta</i> (Kern.) K. Fritsch.	709
	Section 3. <i>Oporinocissus</i> Koehne	
—	3. <i>P. quinquefolia</i> (L.) Planch.	709

PREFACE

With the publication of Volume XIV we conclude the descriptions of the choripetalous plants of the Russian flora.

In Volume XIV the descriptions of 547 wild species of the USSR and 30 cultivated ones are presented.

As in the previous volumes, critical treatment of the material for this publication has disclosed about ten percent of new species, as well as new concepts on the taxonomy of Linaceae (S. V. Yuzepchuk), Zygophyllaceae (A. G. Borisova), Euphorbiaceae (Ya. I. Prokhanov), and Rhamnales (V. I. Grubov).

Aceraceae and Buxaceae and some other trees and shrubs described here by the prominent authority, A. I. Poyarkova, also include taxonomical innovations.

The species of Celastraceae, Anacardiaceae, Aceraceae and Rhamnales described in this volume are currently of special interest as a potential source for expanding the assortment of strains suitable for shelter belts and, in general, for ornamental planting.

This is the first volume to be published after the August 1948 session of VASKhNIL at which Academician T. D. Lysenko delivered his celebrated paper "On the Situation in the Biological Sciences."

In this context we should note I. V. Michurin's standpoint on the plant world of the USSR. In 1932 (Vol. IV, p. 202 of his collected works) he wrote: "It is with pleasure that I welcome the intention to publish a botanical description of the flora growing throughout our Soviet Republic. Such work has long been overdue and its lack has been severely felt in plant cultivation. It is incredible that our leading botanists have allowed this gap to exist up to this day."

Editorial Board

1 Order 24. **Geraniales** LINDL.

Flowers cyclic, with calyx and choripetalous corolla, usually 5-merous; stamens alternate; carpels 2-5, rarely more, often parted when ripe, usually with 1-2 ovules, rarely with many; ovules anatropous, pendulous, with ventral funicle and the micropyle upturned, if ovules numerous then some with dorsal funicle and the micropyle downturned.

Family LXXIX. **GERANIACEAE*** J. ST. HIL.

Flowers hermaphrodite, regular, rarely irregular; sepals 5; petals 5, hypogynous, sometimes alternating with nectaries; stamens 10, connate at base to form a ring, sometimes some stamens without anthers, anthers opening by longitudinal adaxial slit; ovary 5-lobed, 5-locular, often elongate-beaked, 5-3-2-carpeled; fruit separating into 5 (monospermous) mericarps bearing awnlike styles concrescent with long receptacle-appendage into a beak-shaped column. Perennial, rarely annual herbs, very rarely undershrubs, with lobed or more or less deeply cut leaves.

Key to Genera

- 1. Ripe mericarps with awnlike styles coiling from base of fruit upwards 2.
- + Ripe mericarps without awnlike styles, coriaceous, indehiscent, slightly detached from axis; all stamens with anthers; leaves pinnatisect 883. *Biebersteinia* Stech. 2.
- 2. Flowers regular, rarely hardly zygomorphic 3.
- + Flowers distinctly irregular; stamens 10, of which 3-4 without anthers 832. *Pelargonium* L'Hér. 3.
- 3. All 10 stamens with anthers; styles of mericarps arcuately curved upwards when ripe 830. *Geranium* L.
- 2 + Five stamens with anthers and 5 without; styles of mericarps spirally coiled upwards when ripe 831. *Erodium* L'Hér.

Tribe 1. **GERANIEAE** Benth. in Benth. et Hook. f. Gen. pl. I (1862) 270. — Ovary elongate-rostriform, with 2 ovules one above the other; fruits monospermous, ripe mericarps borne on their coiling styles toward summit of axis.

Genus 830. **GERANIUM** ** L. †

L. Sp. pl. (1753) 676; Boiss. Fl. or. I, 369; Voronov in Mat. Fl. Kavk. III, 7, 3; Knuth in Engl. Pflzr. 53, Heft. 43.

Flowers regular, sepals and petals 5; nectariferous glands 5 alternating with petals; stamens 10, free or hardly connate at base; ovary 5-carpeled,

* Treatment by E.G. Bobrov, except for *Erodium* and *Biebersteinia* treated by A.I. Vvedenskii.

** Treatment by E.G. Bobrov.

† From the Greek *geranos*, geranium — crane, due to the form of the fruit.

5-locular, with styles elongating into beak-shaped column crowned by 5 stigmas; ovules 2 in each cell, fruits monospermous. Perennial or annual herbs; leaves opposite or alternate, stipulate, palmately lobed or dissected; peduncles axillary, 2-flowered, rarely 1, sometimes peduncles forming a clustered inflorescence above the stem.

There are more than 250 species in *Geranium*, distributed over the temperate zone chiefly in the northern hemisphere. In the tropics they occur only in the mountainous countries.

Note. The last classification of the genus, proposed by Knuth in 1912, is incomplete and artificial, but nonetheless we have used it as the basis for our study of the Russian species. We are also aware of the discrepancy in including all the annual species in one group, as Gams (Hegi, III, Fl. IV, 3) has correctly pointed out.

Establishing a new and more perfect system of this genus is a work for the future as there is not enough information on the species of the tropical countries and East Asia.

1. Perennial plant, rootstock fleshy, long, sometimes tuberiform-thickened, or plants with fusiformly thickened roots and short rootstock; petals usually more than 1 cm long 14.
- + Annual or biennial plants, rarely perennials (*G. pyrenaicum*, *G. depilatum*, *G. sibiricum*), easily uprooted; petals usually less than 1 cm long 2.
2. Lower cauline leaves pentagonal in outline 3.
- + Lower cauline leaves orbicular, reniform or pentagonal-orbicular 6.
3. Leaves deeply quinquepartite, subquinate, terminal segment petioluled, lateral leaves [lobes?] subsessile, rhombic, deeply pinnatisect; blade of petal as long as claw 27. *G. robertianum* L.
- + Leaves quinquepartite, lobes rhombic, simple, notched-dentate; leaves of *G. sibiricum* deeply dissected into rhombic lobes large-toothed above 4.
4. Stem and petioles viscid with glandular hairs; petals bluish-violet, 7-12 mm long; carpels smooth; awns of sepals 3 mm long 50. *G. bohemicum* L.
- + Stems not viscid; petals pink, 4-6 mm long 5.
5. Stems with hairs spreading above or even recurved, without glandular hairs; peduncles usually with 1 flower; carpels smooth, dorsally stiff-hairy; perennials 49. *G. sibiricum* L.
- + Stems with numerous simple and glandular hairs; peduncles 2-flowered; carpels rugose; annuals ... 48. *G. divaricatum* Ehrh.
6. Lower cauline leaves orbicular or orbicular-reniform 7.
- + Lower cauline leaves pentagonal-orbicular 12.
7. Petals entire 8.
- + Petals emarginate above 9.
8. Sepals transversely rugose-plicate, slightly inflated post anthesis converging above to form conoid calyx; beaked styles falling off in ripe fruit but not coiling; petals long-clawed 28. *G. lucidum* L.

- + Sepals not rugose, not converging-conoid above; beaked styles coiling; petals short-clawed 47. *G. rotundifolium* L.
- 9. Upper leaves alternate, lobes longer than wide; petals not longer than or hardly longer than sepals; annuals or biennials 10.
- + Upper leaves opposite, lobes more or less tetragonal; petals distinctly longer than sepals; perennials 11.
- 10. Stem much branching, sparsely pubescent below; petals ca. 3 mm long, not exceeding sepals; carpels appressed-hairy 45. *G. pusillum* Burm. f.
- + Stem weakly branching, densely pubescent below; petals 4–8 mm long, longer than sepals; carpels glabrous, transversely rugose 46. *G. molle* L.
- 11. Plants short-pubescent, also with many soft, long hairs, peduncles and pedicels glandular; sepals with stiff appressed hairs; plants of the Crimea and the western region of the European part of the USSR 43. *G. pyrenaicum* Burm. f.
- + Plants very densely sub-velutinous-pubescent with short hairs mixed with glandular ones, long soft hairs very rare or absent; Caucasian plants 44. *G. depilatum* (Somm. et Lev.) Grossh.
- 12. Plant glandular in upper part; peduncles short; carpels glandular 7. *D. dissectum* L.
- + Plant without glandular hairs; peduncles longer than leaves 13.
- 13. Sepals 9–10 (11) mm long, with awn ca. 3 mm long; petals ca. 10 mm long 5. *G. columbinum* L.
- + Sepals 5–7 mm long, with awn ca. 2 mm long; petals 5–6 mm long 6. *G. schrenkianum* Trautv.
- 14. Rootstock fleshy, long, oblique, rarely vertical or rootstock short, producing fusiformly thickened roots 15.
- + Underground part of plant usually consisting of 2–3(5) tubers 52.
- 15. Stems [above ground] nearly absent, plant appearing acaulescent or nearly so 16.
- + Stems [above ground] always well-developed 18.
- 16. Rootstock vertical, multicipital; blade of leaf 1.5–3 cm wide, densely fine-hairy, silvery-gray beneath, 5-dissected nearly to base into cuneate, 3-fid obtuse lobes; carpels with 1–3 wrinkles above (West of Transcaucasia) 1. *G. subcaulescens* L'Hér.
- + Rootstock oblique, 2–3-cipital; leaves larger, shallowly 5-fid; carpels not rugose; Central Asian plant 17.
- 17. Flowers brilliant pink or purple (violet when dry); leaves densely grayish-velutinous or sericeous; plants of Fergana Range 30. *G. sophiae* An. Fed.
- + Flowers bright blue-violet, sometimes pure white; leaves spreading-hairy above, subglabrous and grayish beneath 35. *G. saxatile* Kar. et Kir.
- 18. Blades of cauline leaves dissected nearly to base into narrow lobes, lobes strongly pinnatisect into linear or oblong-linear, more or less entire lobules 19.
- + Lobes and lobules not linear or oblong-linear 21.

19. Peduncles usually 1-flowered; petals blood-red, 15–20 mm long; stems covered with spreading-hairs; plants of W. Europe and the Caucasus 2. *G. sanguineum* L.
- + Peduncles bearing 2 flowers; petals purple, pink or violet-red; stems sparingly covered above with appressed hairs; plants of E. Siberia and the Far East 20.
- 5 20. Flowers purple or pink; petals 8–10 mm long; leaves soft, with scarcely distinct nerves beneath; lower cauline leaves septem-partite, heptagonal 3. *G. dahuricum* DC.
- + Flowers bright red or violet-red; petals 1.5–2 cm long; leaves rigid, prominently netted-nerved below; lower cauline leaves quinque-partite, orbicular; rootstock producing underground shoots 4. *G. soboliferum* Kom.
21. Rootstock short, with bundle of fusiform-thickened roots 22.
- + Rootstock long, oblique, thick or thin, without fusiform-thickened or cylindrical roots 25.
22. Lobes of leaf obovate-cuneate, dissected into oblanceolate lobules; petals pale lilac with darker nerves; Far Eastern plants 14. *G. sieboldii* Maxim.
- + Lobes of leaf cuneate, trifid, deeply dentate; petals purple or pink, rarely violet; plants of the Caucasus and S. Crimea 23.
23. Carpels dorsally pectinate-dentate; plant covered with stiff and spreading hairs 40. *G. albanum* M. B.
- + Carpels smooth, not pectinate-dentate at back; plant covered with soft and appressed hairs, sometimes recurved. 24.
24. Stipules linear-setiform, 6–8 mm long; petals pale, narrowly obovate, 12–17 mm long, 5–6 mm wide; stems and branches covered with soft declinate hairs (Transc.) 41. *G. pallens* M. B.
- + Stipules lanceolate-linear, 4–5 mm long; petals obovate, 15–17 mm long, 8–10 mm wide, brilliantly colored; stems and branches covered with appressed recurved hairs 42. *G. tauricum* Rupr.
25. Stems erect, tall, leafy; flowers large, clustered in many-flowered erect umbellate inflorescence at stem apex; lower leaves deeply dissected, pentagonal-heptagonal 26.
- + Stems ascending, thin, leafy; flowers rather large; peduncles long, few, not clustered; leaves deeply parted, but not to base 43.
26. Petals spreading or even recurved in a rotate flower, red-brown; carpels transversely rugose; upper cauline leaves alternate 29. *G. phaeum* L.
- + Petals spreading, not recurved but flower not rotate, except for *G. platypetalum* with petals nearly horizontally spreading 27.
27. Fruiting pedicels erect 28.
- + Fruiting pedicels drooping, erect only at anthesis 39.
- 6 28. Lobes of lower cauline leaves orbicular-rhombic or orbicular; Caucasian plants 29.
- + Lobes of lower cauline leaves ovate or lanceolate; all species except for *G. silvaticum* not found in the Caucasus 34.
- ++ Stem usually bearing only terminal leaves hardly longer than the radical; radical leaves large and numerous, rosetted, blade deeply dissected into 7 lobes; cultivated plant, introduced **G. macrorrhizum* L.

29. Petals blood-red, with large blackish spot at base; stamens and style blackish; carpels with 2-3 wrinkles 9. *G. psilostemon* Ldb.
+ Petals of another color 30.
30. Petals horizontally spreading; plant covered with very long, soft spreading hairs 13. *G. platypetalum* F. et M.
+ Petals not spreading horizontally 31.
31. Entire plant sparingly covered with long white hairs, densely especially under nodes and in upper part 32.
+ Plant appressed-hairy or short-villous, or covered with short scattered hairs 33.
32. Plant without glandular hairs; petals 20-30 mm long; blades of leaves glabrous; radical leaves 6-12 cm wide, pentagonal-orbicular 11. *G. ibericum* Cavan.
+ Plant with long white spreading hairs and shorter glandular ones in peduncles and pedicels; petals 15-20 mm long; blades of leaves pubescent at both sides, especially beneath; radical leaves 5-7 cm wide, pentagonal 12. *G. montanum* Habl.
33. Plant shortly gray-villous; blades of leaves rugose, soft-velutinous, lobes obtuse, crenate-incised 8. *G. renardii* Trautv.
+ Plant glabrous below, short-appressed-hairy above; blades of leaves hairy beneath along nerves, dissected nearly to base into rhombic lobes, lobes deeply dissected into lanceolate lobules 10. *G. gymnocaulon* DC.
34. Flowers large, broadly open; petals ca. 2 cm long; robust plants 35.
+ Flowers small, weakly open; petals 6-15 mm long; slender plant 39.
35. Rootstock 8-10 cm long; lobes of lower cauline leaves irregularly and acutely dentate or incised; plants of the European part of the USSR, Caucasus, W. Siberia, in the east up to the western part of Yenisei region 17. *G. silvaticum* L.
- 7 + Rootstock 0.5-2 cm long; lobes of lower cauline leaves obtusely dentate; plants of E. Siberia from Baikal area in the west to the Far East and Chukchi Peninsula 36.
36. Lower cauline leaves parted for half into ovate, large-toothed lobes; petioles with spreading bristly hairs; pedicels glandular-hairy 15. *G. eriostemon* Fisch.
+ Lower cauline leaves dissected nearly to base into ovate-lanceolate large-toothed lobes, sometimes nearly pinnate-dentate; petioles covered with short recurved hairs or subglabrous; pedicels sparingly simple-hairy, rarely mixed with glandular hairs 16. *G. erianthum* DC.
37. Flowers partly open, campanulate; petals pale or pale lilac, obcordate, emarginate above; stems pubescent only at apex, likewise along peduncles 18. *G. albiflorum* Ldb.
+ Flowers broadly open; petals entire, not emarginate above; stems mostly in upper part with recurved hairs 38.
38. Corolla pale blue to bright lilac; awn of sepal 1-2 mm long 19. *G. pseudosibiricum* J. Mayer.

- + Corolla white or pale pink, with violet nerves; awn of sepal up to 1 mm long; plants of the West Siberian Plain 20. *G. bifolium* Patrin.
- 39. Flowers white; petals 11–15 mm long; calyx cylindrical in fruits; plant of S. Altai, Zaisan depression, Tarbagatai 24. *G. affine* Ldb.
- + Flowers blue-violet, dark purple or purple-violet (white only in very rare cases of albinism) 40.
- 40. Flowers purple-violet or purple for the most part; petals 12–15 mm long; leaves deeply dissected into rhombic lobes, lobes narrowly and pinnately incised into acutely toothed lobules; plants of the extreme west of E. Transcaucasia and the former Kars region 26. *G. finitimum* Woron.
- + Flowers blue-violet or dark-violet; petals 16–23 mm long 41.
- 41. Radical leaves deeply 7-sect, with rhombic-ovate lobes subpinnately dissected into lanceolate lobules 42.
- + Radical leaves dissected nearly to base into 8–9 narrow ovate-rhombic lobes not more than 3–4 mm wide at base, lobes nearly subpinnately and deeply dissected into narrow lanceolate-linear, deeply dentate lobules; plants of Transbaikalian steppes and adjacent Mongolia 23. *G. transbaicalicum* Serg.
- 8 42. Flowers intensively dark violet, large; filaments and style violet; plants of mountains and high mountain meadows in the Caucasus 25. *G. ruprechtii* Woron.
- + Flowers blue-violet or azure-violet, inner parts not intensively colored; plants of the forest and forest-steppe zones of Eurasia, mountains of S. Siberia and north Central Asia 22. *G. pratense* L.
- 43. Blades of lower cauline leaves nearly quinquepartite or tripartite; upper leaves trifid or 3-lobed; lobes of lower leaves ovate 44.
- + Blades of lower cauline leaves nearly septempartite or quinquepartite; upper leaves 3–5-fid; lobes of lower leaves ovate-rhombic 45.
- 44. Petals 17–22 mm long, more than twice as long as sepals; plants of W. Caucasus 38. *G. gracile* Ldb.
- + Petals ca. 7 mm long, hardly longer than sepals; plants of the southern part of the Far East 39. *G. wilfordii* Maxim.
- 45. Pedicels simple-hairy, spreading or even recurved, glandular hairs absent 46.
- + Pedicels glandular-hairy 49.
- 46. Stems erect, firm, solitary, rarely few; lower leaves deeply cordate at base, blades thin, dissected for three-fourths into broadly rhombic acuminate lobes, lobes acutely incised-dentate in upper part; plants of Tien Shan and Dzungarian-Ala-Tau. 21. *G. rectum* Trautv.
- + Stems erect or ascending, slender, 2–3; plants of the European part of the USSR, Caucasus, E. Siberia and the Far East 47.
- 47. Leaves green at both sides; filaments short-ciliate; plants of the European part of the USSR and Caucasus 31. *G. palustre* L.
- + Leaves grayish beneath; filaments hispid dorsally and at margins; plants of E. Siberia and the Far East 48.

48. Hairs soft, velvety, grayish 32. *G. vlassovianum* Fisch.
 + Hairs bristly, long, spreading . . . 33. *G. maximowiczii* Rgl. et Maack.
 49. Peduncles 5–15 cm long; pedicels (1) 2–4 cm long 50.
 + Flowers crowded, as if forming inflorescence at apex of stem or
 branches, on ca. 1 cm long pedicels and rather short peduncles . . 51.
 9 50. Stems 15–40 cm high, ascending to suberect, spreading-branching;
 flowers 2.5–3.5 cm in diameter, pale, pink-violet; plants of unin-
 dated meadows and moist coastlines 34. *G. collinum* Steph.
 + Stems 5–7 cm high or plant nearly or completely acaulescent;
 flowers 3–4 cm in diameter, bright blue-violet, sometimes pure
 white; plants of alpine low herbaceous vegetation
 35. *G. saxatile* Kar. et Kir.
 51. Leaves orbicular, dissected for more than two-thirds into obovate
 deeply pinnatisect lobes with acuminate teeth; plants of Pamir-
 Alai 36. *G. meeboldii* Briquet.
 + Leaves pentagonal-orbicular, parted for half or slightly more into 5,
 broadly incised-dentate lobes; upper leaves nearly 3-lobed; plants
 of N. Fergana 37. *G. ferganense* Bobr.
 52. Lobes of lower cauline and especially of radical leaves pinnatisect
 or pinnatipartite 51. *G. tuberosum* L.
 + Lobes of lower cauline and radical leaves oblong-cuneate, 2–3-fid
 (rarely multifid) into linear, entire or hardly incised lobules . . . 53.
 53. Tubers catenulate, i. e., not compact; plant bearing radical
 leaves 54.
 + Tubers moniliform, i. e., dense; plants without radical leaves . . . 55.
 54. Lobes of radical leaves with 2–4 lateral small lobules; stem short-
 pubescent, with few longer hairs
 52. *G. transversale* (Kar. et Kir.) Vved.
 + Lobes of radical leaves 3-sect into entire linear lobules, without
 lateral segments; stem uniformly covered with small retrorse
 hairs 53. *G. linearilobum* DC.
 55. Lower cauline leaves multisect into linear entire lobes; flowers
 pale lilac or pink (Mtn. Turkm.) 54. *G. kotschyi* Boiss.
 + Lower cauline leaves 5–7-sect into cuneate lobes parted into lance-
 olate lobules; flowers dark pink (southern Pamir-Alai)
 55. *G. charlesii* (Aitch. et Hemsl.) Vved.

Section 1. SUBACAULIS Boiss. Fl. or. I (1867) 869; Voron. in Mat.
 Fl. Kavk. II, 7, 10; Knuth in Engl. Pflzr. 53 Heft, 45, 91. — Rootstock
 10 vertical, fleshy, multicapital; plant subacaulescent; leaves small, silvery;
 carpels with 1–3 wrinkles above.

1. *G. subcaulescens* L'Hér. in DC. Prodr. I (1824) 640; Boiss., Fl.
 or. I, 872, Suppl. 141; Voron. in Mat. Fl. Kavk. III, 7, 10; Grossg.,
 Fl. Kavk. III, 5. — *G. cinereum* β . *subcaulescens* Knuth in Pflzr. 53,
 Heft, 92. — Ic.: Sibth. et Sm. Fl. Gr. tab. 661 (sub. nom. *G. asphodel.*). —

Perennial; rootstock vertical, multicapital, densely covered above with
 old stipules and petioles, producing numerous leaves, thus appearing some-
 what tufted; peduncles 1–3 cm long, finely pubescent, inconspicuous due to

cover of leaf petioles; leaves with 5–10 cm long petioles densely covered with fine hairs, silvery-gray beneath, blades 1.5–3 cm wide, densely and finely pubescent, orbicular, 5-sect nearly to base, lobes cuneate, trifid, obtuse. Pedicels 5–10 cm long, two per peduncle, more distinctly pubescent above; sepals lanceolate, abruptly acuminate, ca. 10 mm long, densely and finely pubescent, silvery; petals obovate, very short-clawed, emarginate, 15–17 mm long, 12 mm wide, purple-violet; filaments pale; carpels with 1–3 wrinkles above, hispid, beak thin, 3.5–4.5 cm long, short-hairy. Fl. July, Fr. August.

Alpine meadows. — Caucasus: W. Transc. (Kvakhid Mountain in former Artvin). **Gen. distr.:** Bal.-As. Min. Described from Parnassus.

Note. Yu. N. Voronov determined the only specimens known to him, which had been collected by Mikhailovskii on Kvakhid Mountain, as the Lazistan variety *G. subcaulescens* var. *lazicam* Woron., distinguished by its two-colored leaves, obtuse lobes, abruptly acuminate sepals, and purple-violet flowers; however, he did not separate it and we have never seen these specimens. Albov's specimens from Kramskaya Yaila are similar to the Kvakhid ones in the color of the corolla, but differ in their glabrous leaves.

Section 2. *SANGUINEA* Knuth. in Engl. Pflzr. 53 Heft (1912) 46, 138. — Leaves orbicular, medium-sized, dissected nearly to base; lobes largely pinnatisect, lobules oblong or oblong-linear, more or less entire.

2. *G. sanguineum* L. Sp. pl. (1753) 683; Ldb. Fl. Ross. I, 460; Shmal'g., Fl. I, 193; Voron. in Mat. Fl. Kavk. III, 7, 15; Knuth in Pflzr. 53 Heft, 138; Syreishch., Fl. Mosk. gub. I, 326; Hegi, III. Fl. IV, 3, 1677; Grossg., Fl. Kavk. III, 3. — *G. grandiflorum* Gilib. Fl. Lithuan. II (1785) 174. — Ic.: Hegi, l.c. tab. 174, f. 1627. — Exs.: G. R. F. No. 913; Fl. Pol. exs. No. 617; Pl. Finl. exs. No. 280; Fl. exs. austro-hung. No. 3213; Fl. exs. Reip. Boh.-Slov., Nos. 123, 425.

- 11 Perennial; rootstock nodose, 5–8 mm thick; stems 20–25 cm high, usually furcately branching to nearly simple, branches spreading, like petioles and peduncles covered above with long spreading hairs, but hairs recurved below stem; leaves petioled, reniform or orbicular, deeply dissected into 5–7 lobes, lobes cut into 3–5 linear or linear-lanceolate, sometimes slightly acuminate lobules, appressed-hirsute bristles above and at margins, and long white-hairy beneath; stems and lower leaves often intensively reddening below towards end of growing. Peduncles long, 1-flowered, rarely 2; bracts ovate or ovate-lanceolate, brownish; sepals oblong-ovate, mucronate at tip, 3–5-nerved, brownish-scarious, long-hairy; petals blood-red, obovate, emarginate, cuneate at base, 15–20 mm long, half as long as sepals; column attenuate above, pubescent, carpels sparingly pubescent, white-hairy above, basally bearded inside; seeds finely dotted in lines. Fl. June–July, Fr. July–September.

Loose forests, shrubby formations at forest edges and lawns, on dry, southern slopes in particular, in northern regions on limestones. — European part: Balt. (in Narva district known from limestones), Lad.-Ilm.

(only in Pskov district, in limestones along the Velikaya River), U. Dnp. (latitude of Smolensk), U. V. (extreme south), V.-Kama (only southwest, to Krasnoufimsk in the northeast), U. Dns., V.-Don, Transv. (north), Bes., Bl., L. Don, Crim.; Caucasus: all regions except Tal. and a larger part of W. Transc. **Gen. distr.:** S. Scand., Atl., Centr. and S. Eur., W. Med., Bal. Described from W. Europe. Type in London.

3. *G. dahuricum* DC. Prodr. I (1824) 642; Ldb. Fl. Ross. I, 468; Turcz. Fl. baic.-dah. I, 258; Kom., Fl. Man'chzh. II, 647; Knuth in Pflzr. 53 Heft. 141. — **lc.:** Kom. and Alis., Opre del. II tabl. 207.

12 Perennial; rootstock thick, short, with bundle of inflated roots, producing few stems; stems 25–50 cm high, nearly erect, appressed-hairy, mostly in upper part; lower leaves long-petioled, dying at anthesis; petioles 8–13 cm long, thin, appressed-hairy; blade heptagonal or reniform-orbicular, covered above with stiff short appressed hairs, long hairy beneath, especially along nerves, dissected very deeply into lanceolate-linear acuminate lobules 2–3 mm wide; stipules lanceolate, filiform-acuminate above. Peduncles axillary, 2-flowered, drooping in fruit, appressed-hairy, the upper shorter; bracts lanceolate, distinctly acuminate, ciliate at margin; sepals ovate, with 1–2 mm long awn, dorsally 3-nerved, scarious and long-hairy at margins; petals purple or pink, more intensively colored along nerves, obovate, 8–10 mm long, white-hairy at base; filaments linear-lanceolate, ciliate at base, hardly longer than calyx; column in fruit two to three times as long as calyx; seeds compressed, finely dotted. Fl. June, Fr. July–August. (Plate IV, Figure 2.)

Dry valley meadows and slopes, shrubby formations and forest meadows. — E. Siberia: Dau. (S.); Far East: Ze.-Bu., Uss. **Gen. distr.:** Mong. (E.), Manchuria, N. China. Described from Transbaikalia, from Patrin's collections. Type in Geneva?

4. *G. soboliferum* Kom. in Tr. B. S. XVIII (1901) 433; Fl. Man'chzh. II, 651; Knuth in Pflzr. 53 Heft, 143; Kom. and Alis., Opre del. II, 692.

Perennial; rootstock short, producing swollen roots and developing lateral shoots (rarely seen in herbaria); stems 25–50 cm high, 1–3, leafless below, erect, angular, glabrous below, sparingly hairy above; radical leaves with 20–40 cm long petioles, glabrous or few hairy; blades reniform-orbicular; cauline leaves in upper third of stem, with pubescent petioles longer than blade; terminal leaves sessile, coriaceous, shortly-appressed-hairy above, sparsely hairy beneath along nerves and margin; blades dissected into 5–7 lanceolate lobes, lobes deeply cut into lanceolate acuminate lobules, all paler glaucescent beneath. Peduncles 2-flowered, elongating up to 3 cm at full blossom, covered with short appressed-retrorse hairs; sepals 0.7–1 cm long, 5–7-nerved, finely appressed-hairy, scarious at margin, tapering-mucronulate; petals violet-red, broadly obovate-cuneate, 2 cm long, pubescent at base, short-clawed; filaments ciliate at the dilated part; fruiting pedicels erect; column 3 cm long, very short-hirsute. Fl. July, Fr. August. (Plate IV, Figure 7).

Marshy meadows, valleys along rivers and streams. — Far East: Uss. (S.). **Gen. distr.:** Manchuria, N. Korea. Described from E. Manchuria. Type in Leningrad.

Section 3. COLUMBINA Koch, Synops. ed.1 (1837) 140, pro min p.; Voron. in Mat. Fl. Kavk. III, 7, 61, p.p.; Gams in Hegi, Ill. Fl. IV, 3, 1668. — Blades of leaves dissected-lobed, lobes cut into linear lobules; petals nearly as long as sepals; annuals.

5. *G. columbinum* L. Sp. pl. ed.2 (1763) 956; M.B.Fl. taur.-cauc. II, 140; Ill. 456; Ldb. Fl. Ross. I, 472; Boiss. Fl. or. I, 881; Shmalg.; Fl. I, 193; Voron. in Mat. Fl. Kavk. III, 7, 68; Knuth in Pflzr. 53 Heft, 50;
- 13 Grossg., Fl. Kavk. III, 3. — *G. roseo-coeruleum* Gilib. Fl. Lithuan. II (1785) 176. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 189. — Exs.: Fl. exs. austro-hung., No. 3217; Fl. eks. Reip. Boh.-Slov., No. 238.

Annual; root thin, terete; stems 20–40 cm high, numerous, erect or ascending, covered with stiff appressed-antrorse hairs, appearing to be spreadingly branching because of the many spreading peduncles; lower cauline leaves orbicular-pentagonal, blades of these leaves 2–3.5(5) cm in diameter (smaller in radical leaves); dissected into 5–7 narrow lobes, lobes cut into linear lobules; upper cauline leaves 3–5-partite, with narrower lobes; stipules lanceolate-subulate, scarious. Peduncles long, spreading; bracts linear; fruiting pedicels spreading, nearly as long as peduncles; sepals lanceolate, 9–10(11) mm long, with awn 3 mm long, scarious at margin, 3-nerved, glabrous, broadly triangular in fruit; petals ca. 10 mm long, pale purple, obcordate, pubescent beneath; carpels glabrous, keeled, beak appressed-stiff-hairy. Fl. May, Fr. June. (Plate V, Figure 7).

Grass stands, shrubby formations on slopes, fields, weedy places. — European part: Balt. (Ezel Island), U. Dns., M. Dnp., Bes., Bl. (Mius), Crim.; Caucasus: everywhere in the foothills and plains but not reported from Transc. Gen. distr.: Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Iran (NW). Described from Centr. Eur. Type in London.

6. *G. schrenkianum* Trautv. ex Beck. in Bull. Soc. Nat. Mosc. LVII, I (1882) 53, nomen; Kryl., Fl. Zap. Sib. VIII, 1833. — *C. gracile* Schrenk in Bull. Acad. Pétersb. III (1845) 308, non Ldb. (1837); O. and B. Fedch., Perech. r. Turk. II, 149.

Annual; much like the preceding species but differing in habit, being very impoverished in all parts. The markedly smaller flowers (sepals 5–7 mm long, with awn ca. 2 mm long, petals 5–6 mm long) serve as differentiating characters. The specific area of distribution also points to its independence. It is typical of the Kazakh folded country where it is widely distributed: in the east it reaches Lepsa valley at the foot of Dzungarian Ala-Tau and Zaisan district, in the north it occurs up to Karkaralinsk and Semipalatinsk, in the Aral-Caspian area it is known from Turgai district and Ulutau village in Karsakpai district. It is found in scattered localities from Buzuluk district and Ergeni near Krasnoarmeisk (Sarepta). Fl. June, Fr. July.

- Moist places and swamps, pebbly and sandy beds of rivers and streams in the southern steppical and semisteppical zone. — European part.: Transv.
- 14 (Buzuluk district), L. V. (Ergeni near Krasnoarmeisk); W. Siberia: Irt. (extreme southeast); Centr. Asia: Ar.-Casp. (extreme northeast), Balkh. Endemic. Described from Khantau, an offshoot of the Chu-Ili Mountains. Type in Leningrad.

Note. The absence of records of this species from Mugodzhar, as well as from the west of the Aral-Caspian district, might mean that it was overlooked.

7. *G. dissectum* L. Cent. I (1755) 21; M. B. Fl. taur.-cauc. II, 189; III, 456; Ldb. Fl. Ross. I, 472; Boiss. Fl. or. I, 881; O. Ktze, in Tr. B. S. X, I, 176; Shmal'g., Fl. I, 193; Voronov. in Mat. Fl. Kavk. III, 7, 70; Knuth in Pflzr. 53 Heft, 51; Grossg., Fl. Kavk. III, 2. — *G. angustifolium* Gilib. Fl. Lithuan. II (1785) 176. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 189. — Exs.: Fl. exs. Reip. Boh.-Slov. No. 1139; Pl. Finl. exs. No. 786.

Annual; stems 15–40 cm high, usually 2–3, ascending to erect, sometimes branching nearly from base, covered below with spreading stiff hairs mixed with numerous glandular ones in upper part; radical leaves orbicular-pentagonal, dissected nearly to base into 5–7 narrow lobes, lobes cut into linear lobules; lower cauline leaves larger, the upper smaller, petioles with stiff recurved hairs, blades especially densely-stiff-hairy beneath. Peduncles short, not longer than petioles, together with pedicels covered with stiff and glandular hairs; pedicels short, as long to twice as long as sepals; sepals lanceolate, flat, with awn 2 mm long, dorsally hispid and glandular; petals 6–8 mm long, almost as long as sepals, obcordate, ciliate at base, lilac, pink-lilac or white (var. *albidum* O. Ktze.); carpels pubescent, beak glandular. Fl. May, Fr. June. (Plate V, Figure 1.)

Fields, crops, roadsides, shrubby formations, gardens, weedy places. — European part: Crim.; Caucasus: everywhere except for the high mountains; Centr. Asia: Pam.-Al. (Kabadian, Kurgan-Tyube, Saiat, Kulyab). **Gen. distr.:** Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Iran. Introduced into the United States. Described from S. Europe. Type in London.

Note. The flowers of the E. Transcaucasian and Talysh plants are usually white, as correctly noted by Voronov (l. c.).

Section 4. SYLVATICA Knuth in Engl. Pflzr. 53 Heft (1912) 45, 107. — *Batrachia* Koch, Synopsis (1857) 137, p.p.; Boiss. Fl. or. I, 869, p.p.; 17 Voronov, in Mat. Fl. Kavk. — Rootstock oblique, producing long roots; stems erect, tall, leafy. Flowers large, fascicled in erect umbelliform terminal inflorescence; petals spreading.

Subsection 1. MEDITERRANEA Knuth in Engl. Pflzr. 53 Heft (1912) 107. — Pedicels glandular, rarely eglandular, erect in fruit; lobes of leaf orbicular. Flowers large.

8. *G. renardi** Trautv. in Trautv. Rgl. Maxim. et Winkl. Decas plant. nov. (1882) 5; Boiss. Fl. or. Suppl. 142; Voronov. in Mat. Fl. Kavk. III, 7, 35; Knuth in Pflzr. 53 Heft, 109. — *G. Brotherusianum* Trautv. in herb.

* Named after K.I. Renard, a leading figure in the Moscow Society of Naturalists.

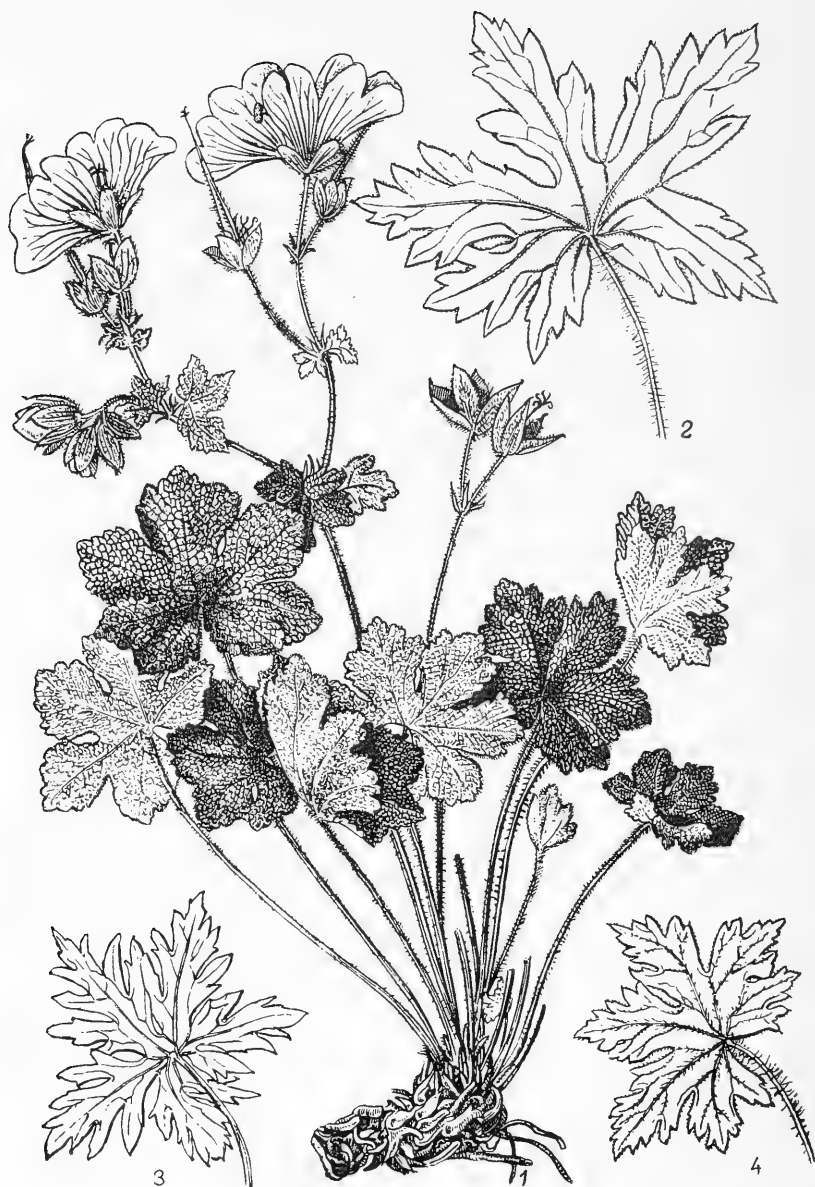


PLATE 1. 1 - *Geranium renardii* Trautv.; 2 - *G. ibericum* Cavan.; 3 - *G. gymnocaulon* DC.; 4 - *G. montanum* HbL.

Perennial; rootstock robust, 10–20 cm long, 1–2 cm thick, developing numerous basal leaves and one, rarely two stems; stems 15–25 cm high, erect, short pubescent with straight spreading hairs, usually simple and leafless, terminal leaves mixed with peduncles at top; radical leaves with short-pubescent 5–11 cm long petioles, blades 5–6 cm wide, pentagonal-orbicular, parted into 5–7 broadly ovate, crenate-dentate lobes, adjacent at margins; terminal leaves nearly 3-lobed, small, blades rugulose, densely velutinous-pubescent beneath with short soft hairs, silvery, gray-green above; stipules lanceolate to lanceolate-linear, lilac-brown. Peduncles 2–5 cm long, together with the two pedicels (1–2 cm) more densely pubescent than stems; bracts linear-subulate, lilac, hairy, sometimes mixed with small, reduced leaves; flowers usually 4 or 8 in loose inflorescence; sepals 10–12 mm long, lanceolate, with 1–2 mm long awn, pubescent outside; intensively bluish-purple inside; petals 17–20 mm long, broadly obovate, deeply 2-lobed, cuneate at base, pubescent, pale lilac with dark violet nerves; fruit pubescent, carpels densely short-hairy. Fl. July, Fr. August. (Plate 1, Figure 1.)

Alpine, rarely subalpine meadows. — Caucasus: Ciscaucasia, E. Transc. (alpine belt of the western part of Main Range). Endemic. Described from Ossetia, from Brutsabseli near Didi-Liakhva. Type in Leningrad.

Note. The hybrid *G. renardii* × *G. platypetalum* was established by Yu. N. Voronov (l. c., p. 37). The plant combines the parental characters and is especially distinguished from *G. renardii* by the more developed branching, leafy long-hairy stems, and by the glandular hairs on the pedicels. Specimens of this kind are known from Elbrus and from Chaparukhscoe ravine in S. Ossetia.

- 18 9. *G. psilostemon* Ldb. Fl. Ross. I (1842) 465; Voron. in Mat. Fl. Kavk. III, 7, 41; Knuth in Pflzr. 53 Heft, 112; Grossg., Fl. Kavk. III, 6. — *G. armenum* Boiss. Fl. or. I (1867) 878. — *G. armenum* var.? Alb. Pr. Fl. Colch. (1895) 46. — *G. armenum* β. Alb. *bowii* Lipsky, Fl. Kavk. (1899) 264, nom. — Exs.: Herb. Fl. Cauc. No. 33; Pl. or. exs. No. 312.

Perennial; rootstock robust, producing 1 stem and 2–5 leaves; stem 35–70 cm high, erect, with furcately spreading branches, appressed-hairy with thin and short but distinct hairs, sometimes unevenly bristly in lower part (below the lower branches); lower leaves with 15–30 cm long, short-appressed-hairy petioles, blades pentagonal-reniform, 15–20 cm wide, 5-sect for two-thirds, lobules large, rhombic, acuminate, incised and acutely toothed; median leaves with shorter petioles, terminal leaves tripartite, with narrow acuminate lobes; all blades short-appressed-hairy above, more densely crisp-hairy beneath, the young leaves nearly lanate beneath. Peduncles 5–20 cm long, shortly appressed-hairy; bracts lanceolate-linear, brownish, glabrous, 8–12 mm long; pedicels 2–8 cm long, appressed-hairy, often glandular, declinate in fruit; flowers few; sepals lanceolate, appressed-hairy, 10–12 mm long, awn 4–6 mm long; petals obovate, obtuse, 20–25 mm long, blood-red, pubescent at base, with black spot, nerves more brightly colored; stamens 7–10 mm long, filaments blackish above (like style), dilated below, pale, pubescent; carpels pubescent, with 2–3 thin wrinkles, beak 25–30 mm long, remotely hairy, sometimes also with glandular ones. Fl. July, Fr. August.

Forest margins and grassplots in the high mountain and subalpine areas. — Caucasus: Dag. (near Durushtal in former Kyurin district), W. and E. Transc. (in S. Ossetia and Gori area and in the west).
Gen. distr.: Turkish Armenia. Described from the Nordmann collections from W. Transcaucasia. Type in Leningrad.

Note. This plant should be cultivated as an ornamental because of the unusual beauty of its flowers.

10. *G. gymnocaulon* DC. Prodr. I (1824) 640; Boiss. Fl. or. Suppl. 142; Voron. in Mat. Fl. Kavk. III, 7, 37; Knuth in Pflzr. 53 Heft, 111; Grossg., Fl. Kavk. III, 6. — *G. amethystinum* Ldb. in Bull. Acad. Petrop. II (1836) 214; Ej. Fl. Ross. I, 461. — *G. ibericum* γ *brachytrichum* Boiss. Fl. or. I (1867) 876. — Exs.: Herb. Fl. Cauc. No. 474.

19 Perennial; rootstock vertical, 10–15 cm long, 1 cm thick, producing 1–2 stems and 5–10 radical leaves; stems 15–30 cm high, ascending, glabrous below, short-appressed-hairy above, without glandular hairs, nearly simple, hardly leafy, bearing only terminal leaves subtending peduncles; leaves (radical) with 10–20 cm long petioles, blades pentagonal, 5–7 cm wide, dissected nearly to base into rhombic lobes, lobes deeply dissected into lanceolate lobules, blades glabrous above, very finely pubescent beneath along nerves or in upper part of petiole; upper layer hardly developed, nearly tripartite, with narrow lobes. Peduncles 3–5 cm long, short-hairy; pedicels paired, short-hairy, ca. 1 cm long; bracts 3–5 mm long, linear, scarious; sepals 7–10 mm long, dorsally short-hairy, pubescent at margins, with 2–3 mm long awn; petals 17–20 mm long, 12–13 mm wide, broadly obovate, emarginate or nearly 2-lobed above, brilliant violet; filaments dilated at base, long-white-hairy at back; carpels dorsally long-hairy, beak 25–30 cm long, short-hairy. Fl. July, Fr. August. (Plate 1, Figure 3.)

Meadows in the alpine and subalpine belts. — Caucasus: Ciscaucasia, W. and E. (in west) Transc. (alpine belt of the Main Range and west of the Lesser Caucasus). Endemic. Descriptions based upon Stephen's collections from Georgia. Type in Geneva.

Note. Var. *pumilum* Rupr. and var. *grandiflorum* Rupr., both varieties of this species established by Ruprecht (Fl. Cau. 271), represent only the more extreme alpine forms.

11. *G. ibericum* Cavan. Quarta Diss. Bot. (1787) 209, tab. 124; M. B. Fl. taur.-cauc. II, 135; III, 454, excl. var. β.; Ldb. Fl. Ross. I, 1, 462; Boiss. Fl. or. I, 876, Suppl. 142; Voron. in Mat. Fl. Kavk. III, 7, 29; Knuth in Pflzr. 53 Heft, 110; Grossg., Fl. Kavk. III, 5. — *G. grandiflorum* Güld. Reisen, I (1787) 420, nomen. — Ic.: Cavan. l. c. tab. 124, fig. 1; Sweet, Geran. I (1820–1822), tab. 84. — Exs.: Herb. Fl. Cauc. No. 32.

Perennial; rootstock robust, developing a stem 30–60 cm high, usually furcately branching from middle; stem, peduncles, pedicels, sepals and petioles covered with soft long hairs, blades glabrous, pubescent only at margins and at base of nerves; radical leaves 3–5,

with petioles 10–30 cm long, blades 6–12 cm wide, pentagonal-heptagonal-orbicular, dissected for two-thirds into irregular rhombic lobes acuminate and uneven above, sometimes bifid and acutely dentate; cauline leaves short-petioled (up to 5 cm), divided into 5 irregularly rhombic lobes, lobes irregularly incised-dentate, the terminal leaves small, sessile; stipules lanceolate-linear, 10–12 mm long, densely long pubescent. Peduncles 3–5 cm long, 2–3 on each branch, bearing 2 pedicels 1–3 cm long, thus forming luxuriant umbelliform inflorescence; bracts linear-subulate, 5–10 mm long, pubescent; sepals reddish, elliptic, ca. 10 mm long, with 2–3 mm long awn; petals cuneate, obcordate or just emarginate, sometimes with denticle at middle of notch, violet with purple veins, 22–30 mm long; filaments sometimes colored above, dilated below and ciliate-hairy; fruit 4–5 cm long, carpels sparingly pubescent. Fl. June–July, Fr. July–August. (Plate 1, Figure 2.)

Subalpine and alpine meadows, grassplots in upper part of the forest belt. — Caucasus: Cisc. (absent in the western part of the Main Range), Dag., W. (Artvin), E. and S. Transc. **Gen. distr.:** As. Min. (Turkish Armenia). Described from the "East" (probably from Transcaucasia) from Tournefort's collections. Type in Paris.

12. *G. montanum* Habl. in Pallas, Neue Nord. Beitr. IV (1783) 51. — *G. ibericum* var. *subglandulosum* Rupr. in Mem. Acad. Sc. Pétersb. VII, ser. XV, 2 (1869), p. p. — *G. ibericum* var. *hyrcanum* Voron. in Mat. Fl. Kavk. III, 7 (1911) 31; Grossg., Fl. Kavk. III, 5. — *G. ibericum* var. *genuinum* Trautv. in herb.

Perennial; resembling the preceding species, differing distinctly in habit. Stems short, ascending, 2–3; plant 15–30 cm high, profusely pubescent with long white spreading hairs, sometimes declinate below stem, peduncles and pedicels in addition with short glandular hairs; leaves up to 7 cm wide, lower leaves nearly pentagonal, dissected for more than half into 5 subrhombic, slightly acuminate, irregularly incised, acutely toothed lobes, upper leaves nearly 3-lobed, all blades shortly appressed-hairy at both sides. Peduncles (3) 5–15 cm long; flowers smaller; petals 15–20 mm long, densely long pubescent at base; filaments with stiff long cilia at base; fruit with densely hairy beak. Fl. July, Fr. August.

Grassplots in the mountain-forest belt, 1,500–2,500 m altitude. — Caucasus: Tal. **Gen. distr.:** Iran (Gilan). Described from Samamiiskie Mountains. Type in Leningrad.

13. *G. platypetalum* F. et M. ex Hohen. in Bull. Soc. Nat. Mosc. VI (1883) 246; Ind. I Sem. H. Petrop. (1835) 28; Ldb. Fl. Ross. I, 462; Voron. in Mat. Fl. Kavk. III, 7, 32; Knuth in Pflzr. 53 Heft, 111; Grossg., Fl. Kavk. III, 6. — *G. ibericum* var. β M. B. Fl. taur.-cauc. II (1808) 135. — *G. ibericum* var. *platypetalum* Boiss. Fl. or. I (1867) 876. — Ic.: Bot. Mag. tab. 1386, sub. nom. *G. iberico*. — Exs.: Fl. cauc. exs. No. 237; Pl. or. exs. No. 340.

Perennial; stems usually solitary, 15–40 cm high, furcately branching at node, like petioles sparingly covered with soft hairs, densely so under nodes; radical leaves irregularly reniform-orbicular, 12 cm wide, long-petioled, dissected for two-thirds into broad obovate lobes almost trifid

and irregularly dentate above; cauline leaves pentagonal-heptagonal, cut into obovate, slightly narrower lobes; terminal leaves nearly 3-fid; blades densely pubescent with thin, soft appressed hairs; stipules lanceolate, densely long hairy. Peduncles erect, 5–10(20) cm long; bracts linear-lanceolate, 12 mm long; pedicels 1–3 cm long, erect, peduncles and pedicels hairy like stem but also with glandular hairs; sepals lanceolate, 8–10(12) mm long, with 4 mm long awn, long hairy toward apex and at back; petals broadly obcordate, cuneate at base, profusely hairy, irregularly and weakly sinuate at margin, 17–20 mm long, blue-violet; filaments colored, dilated and hispid below; carpels pubescent, beak elongating to 25 mm, glandular-hairy. Fl. June, Fr. July.

Meadows and forest stands in the subalpine belt. — Caucasus: in all regions, but in W. Transcaucasia known only in former Artvin district. Gen. distr.: As. Min. (Turkish Armenia), Iran (Gilan). Described from Sarial. Type in Leningrad.

Subsection 2. EUSYLVATICA Knuth in Engl. Pflzr. 53 Heft (1912) 108. — Pedicels glandular, rarely eglandulose, erect in fruit; lobes of leaf ovate or lanceolate.

14. *G. sieboldii* Maxim. in Bull. Acad. Sc. Pétersb. XXVI (1880) 458, pl. japon. excl.; Ej. in Mém. Biol. X, 622; Kom., Fl. Man'chzh. II, 648; Knuth in Pflzr. 53 Heft, 135; Kom. and Alis., Opređelit. II, 692.

Perennial; rootstock short, with fusiform-swollen roots; stems erect, bi- and trifurcate, thickened at nodes, subglabrous below, covered above with recurved hairs; stipules ovate, acuminate; petioles more densely hairy; leaves reniform, the upper subsessile, the radical and lower cauline deeply 5–7-partite, the upper 3-partite, lobes obovate-cuneate, cut into oblanceolate acuminate lobules, short-appressed-hirsute above, spreading-hirsute beneath especially along nerves. Peduncles 2-flowered, shortly and densely pubescent at anthesis, distinctly elongating and drooping in fruit; sepals obovate, awned, 5-nerved; petals broadly obovate, cuneate at base, pale lilac with darker nerves, densely white-hairy covered at base, nearly twice as long as calyx, ca. 1.5 cm; filaments ciliate below; styles scabrous in fruit; seeds oval, finely dotted. Fl. June, Fr. August. (Plate IV, Figure 1.)

Shrubby formations on slopes, dry meadows. — Far East: Ze.-Bu. (only south of Zeya-Bureya Plain and Blagoveshchensk), Uss. Gen. distr.: Manchuria. Described from Manchuria. Type in Leningrad.

22 Note. Maksimovich included both Japan and Manchuria in the distribution area of this species but he denoted the differences between the Japanese and Manchurian populations. Neither the Russian nor later the Japanese authors distinguished one from the other; moreover, in naming *G. japonicum* Fr. et Sav. (1879) some Japanese authors referred the epithet proposed by Maksimovich to the synonymy of *G. japonicum*. There is no question now that the Japanese and Manchurian plants represent separate species. Accordingly, the Manchurian plant, which is Schmidt's specimen from Hun-ch'un district near Posyet district, must be considered as the type of our species. Following Maksimovich, who correctly pointed out

the similarity of this species to the American species of the group *G. richardsonii* F. Mey., we place it in the section *Sylvatica*, contrary to Knuth who included it in the section *Reflexa*.

15. *G. eriostemon* Fisch. in DC. Prodr. I (1824) 641; Ldb. Fl. Ross. I, 464; Turcz. Fl. baic.-dah. I, 255, p.p.; Maxim. Prim. Fl. Amur. 70; Ej. in Bull. Ac. Sc. Pétersb. XXVI, 463, var. excl.; Kom., Fl. Man'chzh. II, 654; Knuth in Pflzr. 53 Heft, 121. — *G. eriostomum* Rgl. (calami lapsu) in Mém. Ac. Sc. Pétersb. IV, 4 (1861) 39.

Perennial; rootstock 0.5–1 cm long, covered above with pale brown wide stipules up to 2 cm long; stems usually single, 25–70 cm high, spreading-hairy, glandular-hairy above and especially on peduncles with capitate hairs, sometimes very densely so; radical leaves 1–3, with petioles two to three times as long as blade, sericeous-spreading-hairy, blades 5–10(15) cm in diameter, pentagonal-reniform-orbicular; cauline leaves short-petioled, the upper sessile, 3-lobed, nearly opposite, blades hirsute particularly beneath and on nerves, parted for approximately half or slightly deeper into 5 large, ovate, lobate, dentate lobes, lobes of upper leaves narrower and longer; stipules of cauline leaves lanceolate, acuminate, 0.6–1 cm long. Peduncles 1–5 cm long, densely covered with spreading capitate hairs (glands) and bearing 3–10 flowers crowded in a globose inflorescence; pedicels short, hardly longer than sepals, covered with spreading-glandular hairs; bracts ovate-lanceolate, acuminate, pubescent at margin; sepals ovate, shortly mucronate, dorsally spreading-hairy, scarious at margin, ca. 1 cm long; petals horizontally spreading, reddish- or bluish-violet, broadly ovate, entire, ca. 2 cm long, bearded at base; filaments long-hairy at the lower dilated part; beak of fruit (column) ca. 3 cm long, with pubescent styles; seeds finely reticulate-dotted. Fl. May–June, Fr. July–August. (Plate II, Figure 4; Plate IV, Figure 3.)

Edges of and glades in coniferous, broadleaved and mixed forests, shrubby formations, dry slopes. — E. Siberia: Ang.-Say. (Transbaikalia — in Verkholensk and Balagansk districts), Dau.; Far East: Ze.-Bu., Uss., Sakh. Gen. distr.: Mongolia, Manchuria, Korea, N. China. Described from Transbaikalia. Cotype in Leningrad.

Note. The Russian plants, which are from the southern regions of the distribution area (Korea and N. China), reaching the southern parts of the USSR in Ussuri district, are strikingly distinctive. They are distinguished by their robustness, more shallowly incised leaves with large lobes, softly lanate-hairy beneath, and longer pedicels. Similar specimens have been recorded under the name *G. eriostemon* var. *hypoleucum* Nakai in Tokyo Bot. Mag. XXVI (1912) 256.

16. *G. erianthum* DC Prodr. I (1824) 641; Ldb. Fl. Ross. I, 464; Maxim. in Bull. Ac. Sc. Pétersb. XXVI, 465; Kom., Fl. Man'chzh. II, 656; Knuth in Pflzr. 53 Heft, 122; Kom., Fl. Kamch. II, 294. — ? *G. maculatum* Ldb. Fl. Ross. I (1842) 465. — *G. erianthum* var. *elatum* Maxim. Prim. Fl. Amur. (1859) 71. — *G. elatum* (Maxim.) Knuth, l. c. 113. — *G. eriostemon* Turcz. Fl. baic.-dah. I (1842–1845) 255, p.p. non Fisch. — *G. eriostemon* β . *orientale* Maxim. in Mém. Biol. X (1880) 629; Ej. in Bull. Ac. Sc. Pétersb. XXVI, 463. — *G. orientale* Freyn in Ö. B. Z. LII (1902) 18; Kom., Fl. Man'chzh. II, 653.

Perennial; rootstock 1–1.5 cm long, crowned by pale brown scarious stipules 1–2 cm long; stems usually solitary, 25–70 cm high, weakly branching above, covered – like petioles – with short reflexed hairs or subglabrous; radical leaves with long petioles three to five times as long as blade, blade deeply 5–7-partite; cauline leaves short-petioled, the upper sessile; blades of lower leaves 6–10 cm in diameter, orbicular, deeply 5–7-sect into ovate-lanceolate, large-toothed lobes, sometimes nearly pinnate-dentate; upper leaves with blades 3-fid into narrow lobes; all blades more or less densely appressed-hairy, especially below, or subglabrous, especially above. Flowers 3–5 crowded on short peduncles, usually not longer than subtending leaves, bracts linear, 3–4 mm long; pedicels shorter than peduncles, usually not longer than calyx, remaining erect in fruit, peduncles and especially pedicels densely covered with simple spreading hairs, rarely mixed with glandular ones; sepals lanceolate-oval, 7–8 mm long, with awn usually not longer than 1 mm, densely covered with long hairs sometimes mixed with glandular ones; petals pink to violet, more than twice as long as sepals, dilated, sparsely long-hairy at base of stamens; carpels with styles densely and shortly pubescent; seeds thinly pitted-dotted. Fl. May–July, Fr. June–August. (Plate IV, Figure 6.)

- 24 Meadows, forest edges, slopes, sometimes rocks. – Arctic: Chuk (?), An.; E. Siberia: Lena-Kol. (to the lower reaches of the Vilyui River in the west); Far East: Kamch., Okh., Ze.-Bu., Uda, Uss. (north only), Sakh. Gen. distr.: Ber., N. Am. Described from Kamchatka. Type in Paris.

Note. The complications in the synonymy of this species might be due to what was originally considered as a diagnostic character: the complete absence of glandular hairs, in contrast to *G. eriostemon* Fisch. Actually, glandular hairs on the peduncles and in particular on the sepals are often found. In spite of the wide range of its distribution, extending from the central part of the Yakut ASSR to Sakhalin and from the upper Amur to Bering Sea area, we were unable to find any distinctive forms. For example, we could trace no differences in habit or other diagnostic characters between the Kamchatka plants, which Komarov had determined as *G. erianthum* f. *communis* Kom., and the Amur specimens, which were referred to as *G. orientale* Freyn or *G. elatum* Knuth. Plant populations from the central part of the Yakut ASSR deserve more study. We have not described the distribution of *G. erianthum* DC. in this area because of lack of material.

17. *G. silvaticum* L. Sp. pl. (1753) 681; M.B. Fl. taur.-cauc. II, 136, III, 455; Ldb. Fl. Ross. I, 464; Boiss. Fl. or. I, 877; Shmal'g., Fl. I, 196; Voron. in Mat. Fl. Kavk. III, 7, 42; Knuth in Pflzr. 53 Heft, 119; Grossg., Fl. Kavk. III, 7; Kryl., Fl. Zap. Sib. VII, 182. – *G. coeruleo-purpureum* Gilib. Fl. Lithuan. II (1785) 175. – *G. purpureo-coeruleum* Ldb. Fl. Ross. I (1824) 465. – *G. albiflorum* Korsh. Tent. Fl. Ross. or. (1898) 90. – Ic.: Hegi, III. Fl. IV, 3, f. 1631. – Exs.: G. R. F. No. 1610; Fl. Pol. exs. No. 149, a, b; Pl. Finl. exs. No. 783; Fl. exs. austro-hung. No. 3214.

Perennial; rootstock nearly vertical or oblique, 10 cm long, slightly broadening above, covered with old stipules of radical leaves; stems few, branching above, erect, 25–60 cm high, barbate, with spreading hairs; radical leaves with petioles long-hairy, twice to four times longer than diameter of leaves, blades appressed-hairy above, pubescent beneath only along nerves, reniform-orbicular, nearly 7-partite into wide rhombic or ovate, deeply pinnatisect or large-toothed lobes; median cauline leaves smaller, with shorter petioles, the upper subsessile and apposite; stipules lanceolate, 1.5–2 cm long, acuminate, pale brown, coriaceous. Inflorescence many-flowered, loose, dichas-
 27 al, peduncles 2-flowered, pedicels erect at flowering and in fruit, covered with simple and glandular spreading hairs; flowers broadly open, lilac-purple or violet, rarely white; sepals oblong-ovate, 3-nerved, pubescent, scarious at margin, 10 mm long, with filiform awn 3 mm long; petals obovate, nearly twice as long as sepals; filaments gradually dilating at base, ciliate from middle; fruiting column 2–2.5 cm long, with appressed-hairy styles; seeds very finely dotted. Fl. June–July, Fr. July–September.

Light coniferous and mixed forests, forest edges and meadows, forest stands in forest-steppe zone, mountain meadows, shrubby formations, and grass plots in arctic zone. — Arctic: Arc. Eur. (from Kolguev Island), Arc. Sib. (W.); European part: all regions except for L. V., Crim. and a large part of Bl. (in the latter only in the east); Caucasus: all regions except for Tal., very rarely in S. Transc.; W. Siberia: Ob, U. Tob. (N.), Irt.; E. Siberia: Ang. Say. (W.), Yenisei. (W.); Centr. Asia: Balkh. (Zaisan district). **Gen. distr.:** Scand., Centr. and Atl. Eur., Bal.-As. Min. Described from N. Europe. Type in London.

Note. Many varieties and forms of this species have been described in W. Europe; in our opinion, none of them have any taxonomic significance. Among the varieties distinguished in the USSR one may note *G. silv. var. alpinum* Rupr. (ex. Woron. l.c.) and *G. silv. var. hirsutum* Rupr. In the Caucasus there is *G. silv. var. myriadenum* Somm. et Lev. (Tr. B. S. XVI (1900) 82). All these varieties differ essentially in character and extent of pubescence. In the high mountains of the Caucasus there is a form which is brightly colored, with large flowers. Deserving of special attention however is the white-flowered forest geranium (*G. silv. var. albiflorum* Kryl. in Tr. Obshch. Est. pri Kaz. un. IX, 6 (1881) 59) described from the high mountains of the northern Urals, which is widespread in the northern and polar areas of the Urals and the adjacent Arctic territories. Many of the authors after Korzhinskii (l.c.) confused this plant with *G. albiflorum* Ldb., which is, of course, incorrect.

According to M. G. Popov *G. alpestre* Schur, distinguished only by the eglandulose pedicels, belongs to this species. It is a subalpine plant with bright pink flowers and is common to the Soviet Carpathians (Chernaya gora).

18. *G. albiflorum* Ldb. Ic. pl. Fl. Ross. I (1829) 6, tab. 18; Ej. Fl. alt. III, 230; Ej. Fl. Ross. I, 463; Turcz. Fl. baic.-dah. I, 259; Maxim. in Bull. Acad. Pétersb. XXVI, 457; Knuth in Pflzr. 53 Heft, 124; Kryl., Fl. Zap. Sib. VIII, 1823. — *G. baicalense* Turcz. ex Bess. in Flora, XVII (1834) 1, Beibl. 9, nomen. — *G. versicolor* Turcz. in herb. — Ic.: Ldb. l. c. — Exs.: Smirn. Pl. alt. exs. No. 53.



PLATE II. 1 - *Geranium transbaicalicum* Serg.; 2 - *G. vlassovianum* Fisch.; 3 - *G. rectum* Trautv.; 4 - *G. eriostemon* Fisch.; 5 - *G. gracile* Ldb.; 6 - *G. phaeum* L.

Perennial; rootstock oblique or horizontal, 10 cm long, crowned by brown scarious stipules and usually producing one, rarely two, stems; stems (20)40–60(100) cm high, erect, branching nearly dichasially above, smooth, glabrous, hairy only above and on peduncles; radical leaves generally 1–2, with long glabrous petioles 4–6 times as long as blade; lower cauline leaves with petioles not longer than blade; blades orbicular-reniform, 10(15) cm wide, 7(12) cm long, with spreading and appressed hairs above, usually glabrous beneath, dissected for three-fourths into 5–7 rhombic shallowly incised lobes; upper leaves sessile, dissected for two-thirds into 3 rhombic lobes shallowly dentate at margin. Peduncles short-spreading-hairy, hairs often glandular, with 2 hairy pedicels; sepals elliptic, usually reddish, sparingly pubescent, scarious at margin, with 1.5 mm long awn; petals obovate, emarginate, 10–15 mm long, hairy at base, twice as long as sepals; flowers white, sometimes pale lilac, weakly open, campanulate; filaments white, dilated, ciliate below, longer than sepals; ovary long-hairy; fruits and beak pubescent. Fl. June, Fr. July.

Mountain meadows in upper forest and subalpine belts, banks, edges and grass plots of forest plains, tall herbaceous meadows, shrubby formations and sections of stony mountainous tundra in the Arctic region. — Arctic: Arc. Eur. (55°E. in Malozemel'skaya Tundra, Bol'shezemel'skaya Tundra), Arc. Sib. (polar Urals, tundras and forest tundras in the Urals and Ob areas); European part: Dv.-Pech. (only northeast, right bank of lower reaches of Pechora); W. Siberia: Ob (eastern slope of polar and northern Urals, lower reaches of Taz River and southeast between the Ob and Yenisei rivers), Irt. (NE), Alt.; E. Siberia: Ang.-Say., Yenisei (to lower reaches of the Yenisei River), Dau. (to Nerchinsk in the east), Lena-Kol. (except for the north?); Centr. Asia: Balkh. (Zaisan district), Dzu-Tarb., T. Sh. (to Alma-Ata and Issyk-Kul in the west). **Gen. distr.:** Dzu-Kash. (Kuldja), Mongolia (N.). Described from Ridder. Type in Leningrad.

Note. The lilac color of the plants growing in the south of Angara River-Sayans noted by Krylov as *f. lilacinum* Kryl. and also the larger corolla of many plants growing in the Arctic (Siberia) should be added to Ledebour's note on the polymorphism of the species.

The major part of its distribution area lies in the mountains of S. Siberia and adjacent territories, the lesser part includes the Arctic (European part), Urals (polar section) and Arctic (Siberia). Since these two parts are connected at the Yenisei River basin, where the species is widely distributed, there is no disjunction in its area, as L. P. Sergievskaya (Krylov, Fl.) has reported. Turchaninov designated in herbaria *G. baicalense* Turcz. and *G. versicolor* Turcz, but he does not refer to these ecological forms in his "Flora"; the first represents plants of high mountain meadows and the second those of high mountain grass plots and rocky places.

19. *G. pseudosibiricum* J. Mayer in Boehm. Abh. (1786) 238; Ldb. Fl. Ross. I, 469; Trautv. in Bull. Soc. Nat. Mosc. I (1860) 461; Korsh. Tentamen Fl. Ross. or. 92; Shmal'g., Fl. I, 195; Knuth in Pflzr. 53 Heft, 124; Kryl., Fl. Zap. Sib. VIII, 1830. — *G. campestre* Schangin in Pall. Neue Nord. Beitr. VI (1793) 12, nomen. — *G. bifolium* Turcz. Fl. baic.-dah. I (1842) 257, non Patrin. — *G. coeruleum* Patrin in DC. Prodr. I (1824) 642. — *G. laetum* Ldb. Ic. Fl. Ross. II (1830) 16; Ej. Fl. alt. III, 228. —

G. szcewaldianum Prodan in Bull. Jard. Mus. Bot. Univers. Cluj. VI (1926) 106, 120. — *G. calvum* Trautv. in herb. — Ic.: Ldb. Ic. Fl. Ross II, tab. 148.

Perennial; rootstock short, ca. 1 cm thick above, producing dark brown fleshy roots, covered above with pale brown stipules; stems 30–60 cm high, sparsely covered with reflexed downturned hairs mostly in upper part; stipules lanceolate, acuminate, 15 mm long in lower leaves, 4–6 mm in upper; radical leaves with 30 cm long petioles, median leaves short-petioled, upper leaves subsessile; blades angular-orbicular, pubescent especially beneath, 7-sect nearly to base into rhombic-lanceolate lobes, lobes pinna-tisect, with linear-lanceolate acuminate lobules. Flowers terminal, twin, forming a loose umbelliform inflorescence; bracts linear, 2–5 mm long, 1 mm wide, pubescent; pedicels drooping before flowering, erect at anthesis and in fruit, densely hairy (var. *eglandulosum* Trautv.), sometimes with glandular hairs (var. *glandulosum* Trautv.); sepals oblong, 3-nerved, dorsally pubescent, scarious at margin, with 1–2 mm long awn; petals pale blue to bright lilac, 6–15 mm long, entire, pubescent at base; filaments dilated below, ciliate; fruits pubescent. Fl. June–July, Fr. July–August.

Light forests, forest edges and grass plots, meadowy slopes and mountainous river-valleys. — European part: V.-Kama (C. and S. Urals, from Krasnoufimsk, Khariuznyi Kamen', Chusovskoi Zaved and Kungur in the north to Orsk in the south), Transv. (only northeast of western border of Belebeevskii kanton); W. Siberia: Ob (SE), Irt. (NE), Alt.; E. Siberia: Ang.-Say., Yenisei, Dau. (Baikal area and Selenge Dauria), Lena-Kol. (known up to central part of Yakut ASSR); Centr. Asia: Dzu.-Tarb. (Zaisan, Tarbagatai, northern slope of Dzungarian Ala-Tau). Gen. distr.: Mongolia. Described from Krasnoyarsk steppes.

- 30 Note. This species is distributed in two areas, the larger includes the mountains of S. Siberia and the enormous adjacent expanse to the Lower Yenisei, the central part of the Yakut ASSR in the north and NW Mongolia in the south. The smaller area consists of sections in the central and southern Urals and in the west of the Urals area. There is no doubt that at one time the areas were contiguous and the disjunction was formed later. It is very interesting to note that the area of this disjunction is populated by *G. bifolium* Patr., which may be regarded as a young and distinct derivative.

20. *G. bifolium* Patr. in DC. Prodr. I (1824) 642. — *G. pseudo-sibiricum* auct. Fl. Sib. pro min. p. non J. Mayer. — *G. asiaticum* Serg. in Sist. Zametk. Gerb. Tomsk. un. I (1934) 1; Kryl., Fl. Zap. Sib. VIII, 1832.

Perennial; much resembling the preceding species, differing by stems, petioles and pedicels covered (beneath) with short simple reflexed hairs; leaves smaller, dissected nearly to base, lobes narrower; awn of sepals up to 1 mm long; corolla white or pale pink with violet nerves. Fl. June, Fr. July.

Light forests and forest meadows mainly in the West Siberian Plain. — W. Siberia: U. Tob (N.), Irt. (N.), Ob (S.), Alt. (N.); E. Siberia: Ang.-Say.

(extreme southwest, apparently not occurring east of the Yenisei, although L. P. Sergievskaya reports that it is distributed in the east up to Transbaikalia). Endemic. Described from Barnaul vicinity. Cotype in Leningrad.

Note. L. P. Sergievskaya was the first in our time to distinguish this taxon from *G. pseudo-sibiricum* J. Mayer and to describe correctly its morphological features. However, as we have ascertained, it was described by Patrin as *G. bifolium* Patrin. The type specimen was found in the Fischer Herbarium at the Botanical Institute of the Academy of Sciences of the USSR.

Because of Platin's diagnosis and Ledebour's misconception of this species it fell into oblivion. Turchaninov actually recognized these plants and distinguished them correctly. In describing the pseudo-Siberian geranium (Fl. baic.-dah. I, 257), he noted that the white-flowered forms are distributed in the pine forests of W. Siberia near Tomsk and Baraba. In another part of his book (p. 259) he calls this white-flowered geranium "a variety of Patrin's species."

21. *G. rectum* Trautv. in Bull. Soc. Nat. Mosc. XXXIII (1860) 459; Knuth in Pflzr. 53 Heft, 182. — *G. erectum* Trautv. ex Rgl. in Tr. B. S. V (1877) 253 (calami lapsu).

Perennial; plant without glandular hairs; rootstock robust; stems usually one, rarely 2, glabrous (var. *glabratum* Trautv.), or sparsely pubescent with spreading soft long hairs (var. *villosulum* Trautv., var. *villosum* Rgl.), 30–50 cm high, angular, suberect, sparsely leafy, few-branched; radical leaves with very long petioles (15–30 cm), blades thin, pentagonal-orbicular, deeply cordate at base, darker above, sparsely appressed-hairy at both sides, 5-sect for three-fourths, lobes broadly rhombic, slightly acuminate, cut into acuminate-dentate lobules in upper half; median cauline leaves short-petioled, nearly opposite, blades smaller, more densely pubescent; upper leaves sessile, nearly 3-lobed, acutely toothed; stipules free, scarious, pale brown, lanceolate. Peduncles 5–16 cm long, thin, usually bifurcate, rarely appearing single; pedicels paired (rarely solitary), thin, 5 cm long, like peduncles sometimes long-hairy, erect or slightly curved at anthesis and post anthesis; sepals oblong-lanceolate, ca. 8 mm long, scarious at margin, sometimes sparsely long white-hairy at back, with ca. 2 mm long awn; petals oblong-cuneate, somewhat obtuse above, hairy below, ca. 2 cm long; flowers at anthesis broadly campanulate; filaments dilated below, ciliate; fruits erect, smooth, shortly appressed-hairy, beak glabrous. Fl. and Fr. July. (Plate II, Figure 3.)

Mountain-forest belt, broadleaved forests, rarely in coniferous. — Centr. Asia: Dzu-Tarb. (Dzungarian Ala-Tau), T. Sh. (not recorded from the extreme west). Gen. distr.: Dzu.-Kash. (extreme west). Described from Baskan valley in the foothills of Dzungarian Ala-Tau. Type in Leningrad.

Note. We refer to this species as the "wood cranesbill" only because of its growth and obvious relationship to wood flora. Due to the character of its leaves and the absence of an inflorescence it is placed in the section *Palustria*, but even there it is rather isolated.

Subsection 3. RECURVATA Knuth in Engl. Pflzr. 53 Heft (1912)
109. — Pedicels glandular, erect at anthesis, before flowering and in fruit.

22. *G. pratense* L. Sp. pl. (1753) 681; Ldb. Fl. Ross. I, 466; Turcz. Fl. baic.-dahur. I, 256; Shmal'g., Fl. I, 196; Voronov in Mat. Fl. Kavk. III, 7, 51; Knuth in Pflzr. 53 Heft, 127; Kryl., Fl. Zap. Sib. VIII, 1826; Grossg., Fl. Kavk. III, 6. — *G. coeruleum* Gilib. Fl. Lithuan. II (1785) 174. — Ic.: Hegi, III, Fl. IV, 3, tab. 174. — Exs.: Fl. Pol. exs. No. 150; Pl. Finl. exs. No. 2001.

32 Perennial; rootstock short, covered with dark brown stipules of basal leaves; stems few (20), 30–80 cm high, branching above, sulcate, covered with spreading or even retrorse hairs; radical leaves numerous, with 10–20(30) cm long petioles, spreading-hirsute, blades 6–12 cm long, reniform-orbicular, shortly appressed-hairy above, short-hairy beneath mostly along nerves, 7-sect nearly to base into rhombic-ovate lobes, lobes nearly pinnatifid into lanceolate lobes; cauline leaves 5-partite, the upper sessile, 3-partite; lanceolate, acuminate, appressed-hairy, 10–15 mm long. Flowers many in umbelliform pseudo-furcate inflorescence; peduncles and pedicels glandular-hairy, 2 pedicels on each peduncle; pedicels drooping before anthesis and in fruit, erect at anthesis; flowers large, broadly open; sepals 10–13 mm long, oblong-ovate, 3-nerved, glandular-hairy, with 3–4 mm long filiform awn; petals lilac-blue, broad, obovate, rounded and entire above, pubescent at base, nearly twice as long as sepals; filaments dilated at base, pubescent below; fruit ca. 3 cm long, beak glandular, filiform above, styles densely pubescent; seeds small, maculate. Fl. June–July, Fr. August.

Forest edges and meadows, loose forests, shrubby formations, moderately moist and dry valley meadows, steppical meadows. — Arctic: Arc. Eur. (Murman Coast, Kanin Peninsula); European part: all localities (in Dvina-Pechora north to Ust'-Tsyl'ma, in steppe zone only in the north), Bl., L. Don, L. V., not known from Crim.; Caucasus: Cisc. (very rarely in northern foothills — in upper reaches of the Kuban River, Kislovodsk district); W. Siberia: all localities, in Ob further north than 61°; E. Siberia: Yenisei (S.), Lena-Kol. (northeast to middle of Yakut ASSR), Ang.-Say., Dau. (outside steppe only in west, Baikal area, and in north); Far East: Uss. (introduced into south along railway line); Centr. Asia: Balkh. (extreme east and Karsakpai district), Dzu-Tarb., Syr. D. (E. Fergana), Pam.-Al. (Alai Range), T. Sh. (except for west). Gen. distr.: Scand., Atl. and Centr. Eur., Dzu.-Kash., Mongolia. Described from N. Europe. Type in London.

23. *G. transbaicalicum* Serg. in Sist. Zametk. Gerb. Tomsk. un. I (1934) 4.

Perennial; very similar to the wood cranesbill but distinguished by its xeromorphic habit and in particular by the strongly dissected leaves; leaves dissected nearly to base into 8–9 narrow ovate-rhombic lobes not more than 3–4 mm wide at base, lobes more or less pinnatisect into narrow lanceolate, deeply linear-dentate lobules. It is also distinguished by the shorter pedicels, usually not exceeding bracts. Fl. July, Fr. August. (Plate II, Figure 1.)

Steppe meadows, steppes and broadleaved forests, dry valley meadows. — E. Siberia: Ang.-Say. (Tuva district, east), Dau. (in southern steppes and basin of Vitim River). **Gen. distr.:** Mongolia (in north and adjacent Manchuria). Described from Byrka district, Transbaikalia. Type in Tomsk.

Note. L. P. Sergievskaya separated the Transbaikalia race as an independent species since it was distinct morphologically and geographically. It should be regarded as a derived meadowy cranesbill developed in the steppes of Transbaikalia and adjacent Mongolia. The distinctive character of the E. Siberian plants attracted the attention of botanists as long as 100 years ago. Ledebour (Fl. Ross. I, 467) noted the features of segmentation of the lamina in plants occurring in Nerchinsk. His second Note to *G. affine* is dedicated to these plants. Turchaninov (Fl. baic.-dah. I, 256) reported that the Irkutsk specimens have short pedicels, sometimes even shorter than the bracts. It should be pointed out however that this character is especially expressed in the Transbaikalia plants.

24. *G. affine* Ldb. Ic. pl. Fl. Ross. IV (1833) 20, tab. 371; Ej. Fl. alt. III, 229; Ej. Fl. Ross. I, 466; Knuth in Pflzr. 53 Heft, 129; Kryl., Fl. Zap. Sib. VIII, 1828. — *G. pratense* β . *affine* (Ldb.) Kryl., Fl. Altaya. I (1908) 195. — Ic.: Ldb. l. c. (1833) tab. 371.

Perennial; very similar to *G. pratense* L. from which it differs by the following characters: flowers smaller, white, petals 11–15 mm long; stipules and bracts narrower and longer; calyx in fruit narrower, slightly cylindrical; filaments less ciliate. Fl. June–July, Fr. August.

Meadows in mountain river valleys, meadows on low mountain slopes, broadleaved forests, moist forest glades. — W. Siberia: Alt. (western foothills, S. Altai); Centr. Asia: Balkh. (Zaisan district), Dzu-Tarb. (Tarbagatai). **Gen. distr.:** Mongolia (Mongolia Altai, S.). Described from meadows in Verkhniy Irtysh, S. Altai). Type in Leningrad.

25. *G. ruprechtii* Woron in Mat. Fl. Kavk. III, 7 (1908) 52 (pro subsp.); Grossg., Fl. Kavk. III, 7. — *G. pratense* subsp. β . *Ruprechtii* Knuth in Pflzr. 53 Heft (1912) 128. — *G. batrachioides* β . *cyanostemon* Rupr. Fl. Cauc. I (1869) 273. — *G. pratense* β . *cyanostemon* Boiss. Fl. or. Suppl. (1884) 143.

Perennial; very similar to *G. pratense* L., differing by the violet color of the stamens and stigma, the larger flowers, dark violet, with more intensively colored corolla, the strongly pubescent filaments and looser inflorescence (with smaller number of flowers). Fl. July, Fr. August.

Mountain (and high mountain) meadows. — Caucasus: Cisc., Dag., E. Transc. (in high mountain belt of Greater Caucasus Range, from Teberda to Kuba district), S. Transc. (Lake Sevan and Nor-Bayazet). Endemic. Described from Dagestan. Type in Leningrad.

Note. Two varieties in Dagestan were distinguished by Yu. N. Voronov (l. c.) in this species: one according to the nature of growth (var. *diffusum* Woron.), the other to the intensive pubescence (var. *buschianum* Woron.).

26. *G. finitimum* Woron. in Mat. Fl. Kavk. III, 7 (1908) 50; Grossg., Fl. Kavk. III, 7. — *G. pratense* subsp. γ . *finitimum* (Woron.) Knuth in Pflzr. 53 Heft (1912) 129.

Perennial; in contrast to the other members of the group "Pratense" this plant has small flowers, apparently purple-violet, with purple pre-dominating; petals 12–15 mm long, densely villous at base; leaves deeply dissected to base into rhombic lobes, lobes narrowly pinnatisect and acutely toothed (reminiscent in segmentation of the blade of *G. transbaicalicum* Serg.); stems branching above middle; plant covered with short recurved slightly appressed hairs; hairs on peduncles and pedicels glandulose. Fl. July.

Mountain (and high mountain) meadows. — Caucasus: E. Transc. (near Gorelovka in Akhalkalaki district); well known from former Kars region (Soganlui Range, Sarykamys, near Turkish border). Gen. distr.: probably growing in Turkish Armenia. Described from the Radde collections from the Turkish border. Type in Leningrad.

Section★ UNGUICULATA Boiss. Fl. or. I (1867) 869; Knuth in Pflzr. 53 Heft, 45, 89. — Petals long-clawed, claw ciliate; stamens hardly dilated at base; carpels transversely rugose. Rootstock robust. Four south European and Mediterranean species refer to this group.

★*G. macrorrhizum* L. Sp. pl. ed. I (1753) 680; Boiss Fl. or. I, 871; Knuth in Pflzr. 53 Heft, 89; Hegi, III. Fl. IV, 3, 1708; Szaf., Kulcz., Pawl. Rosl. Polskie, 321. — Ic.: Hegi, l. c. f. 1646. — Exs.: Fl. Ital. exs. No. 473; Fl. exs. austro-hung. No. 2838; Fl. Hung. exs. No. 53.

35 Perennial; rootstock 10–15 cm long, horizontal, ca. 1 cm thick, densely covered with squamiform stipules; the whole plant pubescent; stems 20–40 cm high, pseudo-dichotomously branching above their lower third; radical leaves with thinly sulcate petioles 10–20 cm long, 2–3–4[?] times longer than width of blade, blade 6–10 cm wide, orbicular, palmately dissected for four-fifths, lobes cuneate-obovate to oblong, strongly incised-dentate, teeth acuminate; upper leaves sessile, with smaller lobes. Peduncles 1–6 cm long; pedicels short, usually ca. 1 cm long, erect in fruit; flowers partly approximate above; sepals ovate, 3-nerved, with 1–2 mm long awn; petals spatulate, blood-red; filaments brightly colored, 2–3 times as long as sepals; anthers caducous; style with glabrous violet stigma; carpels sometimes glabrous, transversely rugose. Fl. June, Fr. July–August.

Cultivated as an ornamental plant, sometimes escaped. — European part: U. Dns. (E. Carpathians, Irovysch), Crim. (Romanovskoe Shosse and monastery cemetery near game reservation). Gen. distr.: S. and Centr. Eur., Bal. Described from cultivated specimens. Type in London.

Note. This plant has been under cultivation for many years in N. and C. Europe because of the brightness and fragrance of its flowers. It is an officinal and honey-bearing plant and undoubtedly was introduced into the Crimea where it was recently discovered by S. V. Yuzepchuk. The only record of its occurrence in the Carpathians must also be of a cultivated or introduced plant. Its natural area is restricted to the north at the southeastern Alps and Transylvania.

Section 5. ROBERTIANA Boiss. Fl. or. I (1867) 871; Woron. in Mat. Fl. Kavk. III, 7 (1908) 75. — Petals long-clawed, like filaments glabrous at base; calyx pyramidally angular. Carpels rugose; seeds smooth.

27. *G. robertianum* L. Sp. pl. (1753) 681; M. B. Fl. taur.-cauc. II, 140; Ldb. Fl. Ross. I, 473; Boiss. Fl. or. I, 883; Shmal'g., Fl. I, 191; Voron. in Mat. Fl. Kavk. III, 7, 75; Knuth in Pflzr. 53 Heft, 64; Grossg., Fl. Kavk. III, 2; Kryl., Fl. Zap. Sib. VIII, 1834. — *G. foetidum* Gilib. Fl. Lithuan. II (1785) 178. — *Robertianum nostrum* Goldb. in Mém. Soc. Nat. Mosc. V (1817) 133. — *G. Robertianum* γ . *mosquense* Ldb. l.c. p. 474. — *G. mosquense* Goldb. ex Knuth, l.c. 65. — *G. Robertianum* var. *tenuisectum* Alb. Prodr. Fl. Colch. (1895) 45. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 187; Hegi, III. Fl. IV, 3, tab. 173. — Exs.: G. R. F. No. 1609; Fl. cauc. exs. No. 118; Fl. Pol. exs. No. 616; Pl. Finl. exs. No. 282; Fl. exs. austro-hung. No. 2845.

Annual; stems 15–40 cm high, covered with long spreading hairs, and partly with glandular ones, ascending, branching; lower cauline leaves pentagonal, quinate, the upper nearly ternate, the terminal segment petioled, the lateral subsessile, rhombic, pinnatisect into entire or incised-dentate lobules, blades thin, spreading-hairy at both sides. Peduncles long, spreading declinate in fruit but turned upward, with 2 glandular pedicels; sepals erect, converging above, with long awn, hispid at back and margin; petals 12–15 mm long, twice as long as sepals, with limb as long as claw, entire and rounded above, pale purple; carpels reticular-rugose; seeds finely dotted. Foetidous plant. Fl. May–August, Fr. June–September. (Plate V, Figure 6.)

Shady, broadleaved, 'dark' coniferous and mixed forests, rocks in shady moist places, sometimes parks as an introduced plant, and near dwelling places. — European part: Balt., Lad.-Ilm. (SW), U. V., V.-Kama, U. Dnp., M. D., V.-Don, Transv. (Buguruslan), Bl., Crim., L. Don, Urals (to Zilair in the south); Caucasus: all forest regions except for high mountains; W. Siberia: Alt.; Centr. Asia: Balkh. (E.), Dzu-Tarb., Pam.-Al. (Zeravshan Range), T. Sh. (N.). **Gen. distr.:** Atl., Centr. and S. Eur., W. and E. Med., Iran., introduced into N. Am. Described from N. Europe. Type in London.

Var. *purpureum* (Vill.) DC. Fl. Fr. IV (1805) 853; Ldb. Fl. Ross. I, 474; Shmal'g., Fl. I, 191; Knuth in Pflzr. 53 Heft, 66. — *G. purpureum* Vill. Pl. Delph. (1785) 72; M. B. Fl. taur.-cauc. II, 144; III, 456; Boiss. Fl. or. I, 783; Voron. in Mat. Fl. Kavk. III, 7, 82; Grossg., Fl. Kavk. III, 2. — Ic.: Rchb. Ic. Fl. Germ. tab. 187. — Differing from type by smaller dimensions, thicker and less deeply dissected leaves; smaller flowers, petals up to one and a half times as long as sepals; carpels more wrinkled. — In open and dry habitats. — European part: Crim.; Caucasus: W. and E. Transc., especially along coastline. Described from S. France. Type in Paris.

Note. It is more accurate to treat these plants, which Russian botanists have classified as *G. purpureum* Vill., as a variety of *G. robertianum* since the morphological distinction is not clear-cut and there are many transitional forms. These plants occupy open and dry places.

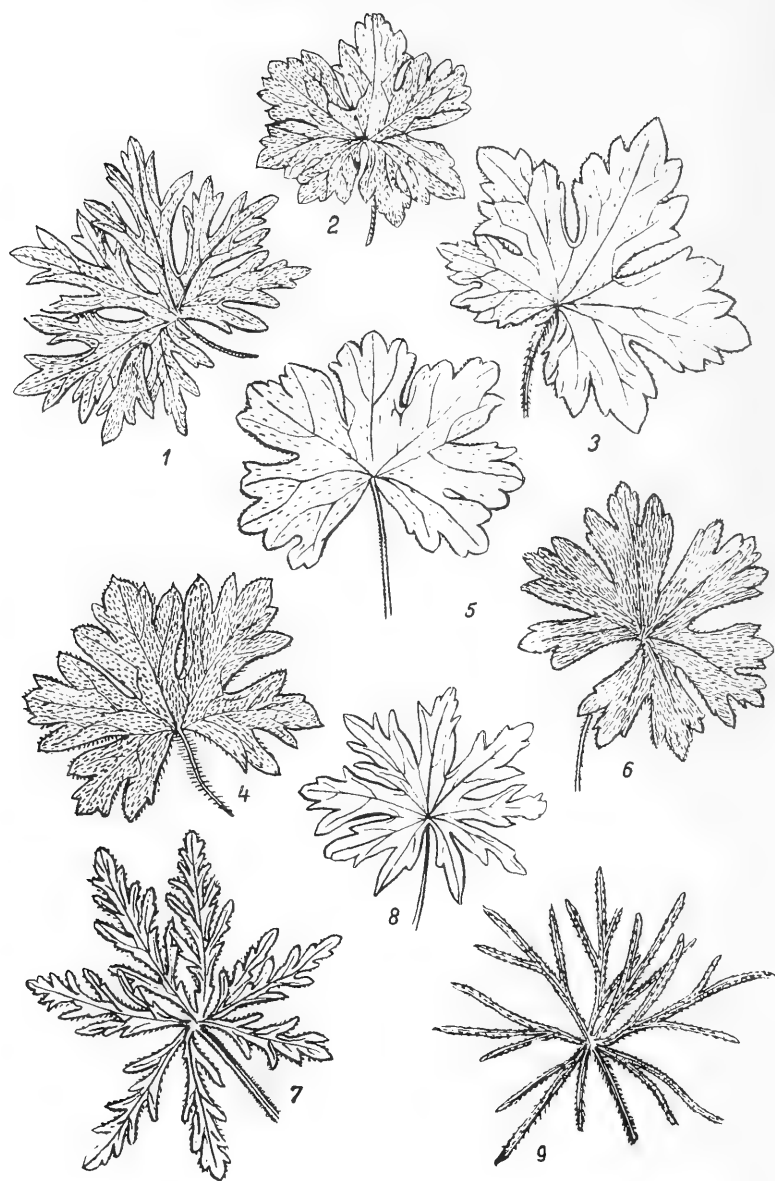


PLATE III. 1—*Geranium collinum* Steph.; 2—*G. saxatile* Kar. et Kir.; 3—*G. ferganense* Bobr.; 4—*G. pyrenaicum* Burm. f.; 5—*G. tauricum* Rupr.; 6—*G. albanum* M. B.; 7—*G. tuberosum* L.; 8—*G. charlesii* (Aitch. et Hemsl.) Vved.; 9—*G. linearilobum* DC.

28. *G. lucidum* L. Sp. pl. (1753) 682; M. B. Fl. taur.-cauc. II, 141; Ldb. Fl. Ross. I, 471; Boiss. Fl. or. I, 884; Shmal'g., Fl. I, 142; Voron. in Mat. Fl. Kavk. III, 7, 83; Knuth in Pflzr. 53 Heft, 63; Grossg., Fl. Kavk. III, 3. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 187. — Exs.: Herb. Fl. Cauc. No. 227; Fl. austro-hung. No. 2844; Herb. Norm. No. 5019; Pl. Finl. exs. No. 281, a, b.

Annual; stems 15–25 cm high, ascending or erect, 2–3, shiny, glabrous, brownish, later reddening; radical leaves long-petioled, withering early; lower cauline leaves with shorter petioles, pubescent below, blades larger, orbicular-rhombic, dissected for two-thirds into 5–7 obovate lobes rounded above and shallowly incised, lustrous, appressed-hairy above and at margin, later reddening; stipules lanceolate, acuminate. Peduncles 2–4 cm long, spreading in fruit, bearing two 1–1.5 cm long pedicels; sepals ovate-lanceolate, acuminate-short-mucronate, scarious at margin, dorsally scabrous and transversely wrinkled, slightly inflated at end of flowering forming conoidal calyx; petals longer than sepals, obovate-oblong, long-clawed, rounded above, 8–10 mm long; carpels dorsally reticular-rugose, beak long attenuate, scabrous; seeds smooth. Fl. April–May, Fr. May–June. (Plate V, Figure 2.)

Rocks in shadow of trees and shrubs, moist shady places. — European part: Balt. (Ezel Island), Bl. (Kirovograd), L. Don, Crim.; Caucasus: all localities except for high mountains and Colchis, but often occurring in eastern regions; Centr. Asia: Mtn. Turkm. (from Kara-Kala to Gaudan, rare). Gen. distr.: Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Iran. Described from W. Europe. Type in London.

Section 6. REFLEXA Knuth in Engl. Pflzr. 53 Heft (1912) 45, 130, p. p. — Upper cauline leaves alternate; sepals with short mucro, corolla rotate, petals recurved or declinate; carpels transversely wrinkled.

29. *G. phaeum* L. Sp. pl. (1753) 681; Ldb. Fl. Ross. I, 463; Shmal'g., Fl. I, 196. — *G. lividum* L'Hér. Geran. (1788) tab. 39. — *G. moldavicum* nom. in herb. Fisch. — Ic.: Rchb. Ic. Fl. Germ. III, 197. — Exs.: Fl. exs. Boh.-Slov. No. 426; Fl. exs. austro-hung. Nos. 2841, 2842.

Perennial; rootstock descending, nodose, crowned with old stipules; stems 30–70 cm high, erect, branching above, covered with long spreading hairs mixed above with glandular ones; radical leaves with 10–30 cm long glabrous petioles, blades reniform-orbicular, angular, 5–10 cm wide, dissected for nearly three-fourths into 5–7 broadly cuneate-rhombic lobes, strongly incised-dentate, appressed-long-hairy above, short-hairy or glabrous beneath; cauline leaves smaller, with shorter petioles; stipules ovate-lanceolate, abruptly acuminate, pubescent, brownish. Peduncles axillary, 2–4 cm long, pubescent; pedicels drooping before anthesis, later declinate-spreading; sepals 9–11 mm long, oblong-ovate, with short awn, 3-nerved, long-hairy at margin and base; petals ca. 12 mm long, obovate-orbicular, undulant at margin, dark, purple-brown; stamens slightly shorter, ciliate at base; carpels with 4–6 wrinkles, pubescent at base, beak 2.5 cm long, finely pubescent. Fl. May–June, Fr. June–July. (Plate II, Figure 6.)

Broadleaved forests, forest edges, shrubby formations. — European part: U. Dns., Bes. **Gen. distr.:** Centr. and S. Eur., Bal. Described from mountainous regions of Hungary. Type in London.

- 40 Section 7. PALUSTRIA Knuth in Engl. Pflzr. 53 Heft (1912) 47, 474. — Flowers rather large; peduncles long; radical leaves deeply dissected but not to base; blades of leaves 5-partite, lobes rhombic-ovate.

30. *G. sophiae* An. Fed. in Botan. Zhurn. SSSR. XXXIII, 1 (1948) 28, tabl. 1.

Perennial; rootstock producing underground brownish shoots, covered with old petioles and stipules; stems 2–5 cm long, hardly conspicuous, canescent with short appressed hairs; leaves mostly radical, with 10 cm long thin petioles canescent with appressed hairs; blades 2–3 cm in diameter, orbicular, canescent with dense-appressed short hairs, hairs longer and more dense above, dissected nearly to base into 5–7 overlapping, broadly cuneate lobes, lobes incised for one-third into 3–4 broadly lanceolate, sometimes rounded above lobules; cauline leaves 1–1.5 cm in diameter. Peduncles ca. 5 cm long; pedicels paired, 2.3 cm long, peduncles and pedicels appressed-hairy without glandular hairs; sepals ca. 10 mm long, lanceolate, acuminate, slightly cap-shaped above, with short awn, densely covered with stiff and rather long hairs, sometimes colored at margin; petals 2.5 cm long, obovate, emarginate, pink or purple, violet when dry; filaments violet, dilated at base; carpels with short and stiff hairs, beak ca. 2.5 cm long, lilac-brown, short-hairy. Fl. and Fr. August.

Rubbly taluses in high mountain belt. — Centr. Asia: T. Sh. (Fergana Range). Endemic. Described from the peak of Baubash-Ata in Fergana Range. Type in Leningrad.

Subsection 1. EUPALUSTRIA Knuth in Engl. Pflzr. 53 Heft (1912) 174. — Pedicels covered with simple, eglandulose, declinate or recurved below sub-flow at anthesis and in fruit retrorse hairs.

31. *G. palustre* L. Cent. II (1756) in Amoen. Acad. IV, 323; Ldb. Fl. Ross. I, 467; Boiss. Fl. or. I, 874; Shmal'g., Fl. I, 196; Voron. in Mat. Fl. Kavk. III, 7, 47; Knuth in Pflzr. 53 Heft, 176; Grossg., Fl. Kavk. III, 8; Kryl., Fl. Zap. Sib. VIII, 1829. — *G. purpureum* Gilib. Fl. Lithuan. II (1785) 175, non Vill. — Ic.: Hegi, III. Fl. IV, 3, Taf. 176, 2. — Exs.: Fl. Pol. exs. No. 917; Pl. Finl. exs. No. 784; Fl. exs. austro-hung. No. 491.

- 41 Perennial; rootstock ascending, covered with old stipules of radical leaves, producing 1–2–3 stems and few leaves withering early; stems 30–70 cm high, erect or ascending, usually weak, with long internodes, thickened at nodes, much furcately branching, beset — like petioles — with spreading and recurved simple hairs, glandular hairs absent; radical leaves 20 cm long and with pubescent petioles, 7-sect nearly to base, pubescent at both sides; cauline leaves 5-partite, lobes rhombic, shallowly incised or large-toothed; upper leaves sessile, 3-partite; stipules dry-coriaceous,

reddish-brown, ovate-lanceolate, long acuminate. Inflorescence much longer than subtending leaves; peduncles 5–10 cm long, bearing 2 pedicels; pedicels 2–5 cm long, recurved below sub- and post-anthesis; flowers large, 2.5–3 cm in diameter; sepals ovate, 5–7-nerved, appressed-hirsute, coriaceous at margin, with long awn; petals obovate, purple, entire above, ca. 1.5 cm long, twice as long as sepals, cuneate at base and pubescent inside; stamens as long as sepals, filaments gradually dilating below; carpels spreading-hairy; seeds smooth. Fl. June–July, Fr. August–September.

Moist and mountainous meadows, valleys and forest edges, grassy marshes, shrubby formations. — European part: Kar.-Lap. (introduced in Imandra and along coast of Knyazhaya Guba), Lad.-Ilm.m Dv.-Pech. (S.), Balt., U. Dnp., U. V., V.-Kama (east, i. e., Urals proper, rare in Molotov district, Talitski Zavod, Zilair), U. Dns., Bes. (N.), M. Dnp., V.-Don, Transv. (Buguruslan), Bl. (Velikoanad forestry), L. Don (Shakhty); Caucasus: Main Range, all localities, absent in W. Transc. and Talysh, rare in S. Transc. and known only in Lori and Nor-Bayazet. Gen. distr.: Scand., Centr. and S. Eur., Bal. Described from Russia. Type in Leningrad.

Note. *G. palustre* β . minus Bess., which was described by Besser (Bess. Enum. pl. (1822) 28 and Ledebour (Ldb. l. c.), is not known to us. It is assumed that it is of no taxonomic significance.

32. *G. vlassovianum** Fisch. ex Link, Enum. Hort. Berol. II (1822) 197; DC. Prodr. I, 641; Spreng. Syst. veget. III, 72; Ldb. Fl. Ross. I, 463; Turcz. Fl. baic.-dah. I, 254; Kom. Fl. Man'chzh. II, 649; Knuth in Pflzr. 53 Heft, 178. — *G. selengense* Prodan in Bull. Jard. et Mus. Bot. Univers. Cluj, VI (1926) 108, 121. —? *G. berezovkaeanum* Prodan, l. c. p. 108, 120. — Ic.: Kom. and Alis., Opredele. II, 692, tabl. 207.

Perennial; rootstock short, crowned with stipules of radical leaves; stems 2–4, ascending or erect, 30–50 cm high, branching, spreading-hairy and angular above, glabrous and rounded below; radical and lower cauline leaves with petioles pubescent at apex, 2–4 times as long as blades, blades reniform-orbicular, shortly-appressed-hairy at both sides, lighter beneath; stipules connate; lower leaves 5-partite, the upper 3-fid with cuneate, apically large-toothed lobes, the median leaves nearly entire, acuminate; terminal leaves opposite, subsessile, narrow, large-toothed. Peduncles 2, spreading-hairy; bracts lanceolate, pale brown, ciliate; sepals 5–7-nerved, mucronate, scarious at margin; petals ca. 2 cm long, almost twice as long as sepals, broadly obovate, entire, purple-lilac, nerves more intensely colored; stamens hardly longer than sepals, ciliate beneath; column beak-shaped, with pubescent styles, 3 cm long; seeds very finely wrinkled. Fl. June–July, Fr. July–August. (Plate II, Figure 2; Plate IV, Figure 5.)

Moist meadows, marshes, riverbanks and streams. — E. Siberia: Ang.-Say., Dau., Lena-Kol. (S.); Far East: Ze.-Bu., Uda (?), Uss. Gen. distr.: Mongolia, Manchuria. Described from Doroninsk district along Ingoda River in S. Transbaikalia. Cotype in Leningrad.

* Named after its collector Vlasov, Governor of the town of Doroninsk.

33. *G. maximowiczii* Rgl. et Maack. in Rgl. Tent. Fl. ussur. (1861) 38; Maxim. in Bull. Acad. Sc. Pétersb. XXVI, 462; Kom., Fl. Man'chzh. II, 650; Knuth in Pflzr. 53 Heft, 179. — *G. Vlassovianum* f. *setosopilosa* Maxim. Prim. Fl. Amur. (1859) 70. — Ic.: Rgl. l.c., tab. III, figs. 4–6.

Perennial; very similar to the preceding species from which it differs by larger habit, 40–70 cm high, stems and petioles spreading-hirsute, larger leaves, stipules parted, pedicels recurved in fruit, sepals with long awn, dorsally hispid, petals ca. 1.5 cm long. Fl. July–August, Fr. August.

Leafy, shady, inundated forests. — Far East: Ze.-Bu. (SE), Uda (extreme south), Uss. Gen. distr.: Manchuria, Korea. Described from southern part of lower Amur. Type in Leningrad.

Note. The independence of this species is still questionable and perhaps Maksimovich was right when he suggested that it is only a shade form of *G. vlassovianum*. However, there is no doubt that it is geographically defined. It might be that it represents a specific Manchurian-Korean race insufficiently known in the USSR.

Subsection 2. *COLLINA* Knuth in Engl. Pflzr. 53 Heft (1912) 175. — Pedicels usually with glandular hairs, not recurved before anthesis, somewhat declinate in fruit but also not recurved.

The unusual variability of *G. collinum* s. l. attracted the investigators of Russian flora as long as 100 years ago and is reflected in the many names proposed to distinguish species, varieties and forms. It can be seen below in the nomenclatural items. The relationship between the populations of plains and foothills and those of the alpine belt has been
43 clearly outlined by Komarov (Tr. SPb. Obshch. Est. XXVI, 149) who also agreed with Maksimovich, that *G. collinum* of Central and Middle Asia represents "a group of forms interrelated by numerous transitions not yet fully established." The plants described from W. Himalayas and Tibet, which are still comparatively unknown and inadequately represented in collections, should be added to this group. Our proposal is to refer all known material to four separate species, one of them might be *G. collinum* s. l.; at the same time it is still very schematic. It should be noted that the variability of the Russian races in character and degree of pubescence is very great, and the forms earlier established and referred to us to *G. collinum* s. str. may also be recognized as other taxa.

34. *G. collinum* Steph. ex Willd. Sp. pl. III (1800) 705; M. B. Fl. taur.-cauc. II, 137; III, 455; Ldb. Fl. Ross. I, 467; Boiss. Fl. or. I, 874; Rgl. and Tp. B. C. I, 252; Shmal'g., Fl. I, 195; Kom. in Tr. SPb. Obshch. Est. XXVI, 149; Voron. in Mat. Fl. Kavk. III, 7, 48; Knuth in Pflzr. 53 Heft, 185; Kryl., Fl. Zap. Sib. VIII, 1829; Grossg., Fl. Kavk. III, 8. — *G. Londesii* Fisch. ex Link, Enum. hort. berol. II (1822) 196; Ldb. Fl. alt. III, 230. — *G. longipes* DC. in Mém. Soc. Phys. Genève, I (1822) 442; Ej. Prodr. I, 642. — *G. longipes* var. *adenotrichum* Schrenk, Enum. I, pl. nov. (1841) 90. — *G. collinum* α. *glandulosum* Ldb. Fl. Ross. I (1842) 467; Knuth in Pflzr. 53 Heft, 186. —

G. collinum var. *adenotrichum* (Schrenk) Briq. in Ann. Conserv. Jard. Bot. Genève, XI–XII (1908) 185; Kryl., l. c. — *G. collinum* β . *eglandulosum* Ldb. l. c. (1842) 468; Knuth, l. c. — *G. collinum* var. *hirsuta* Trautv. in Bull. Soc. Nat. Mosc. XXXIII (1860) 459. — *G. collinum* e. *viscosum* Rgl. ibid. — *G. collinum* var. *wakhanicum* Paulsen in Bot. Tidskr. XXVII (1906) 133. — *G. longipedatum* St. Lag. in Ann. Soc. Bot. Lyon, VII (1880) 126, sec. Knuth.

Perennial; rootstock thin; stems 1–3, 15–40 cm high, ascending or nearly erect, appressed-hairy mostly above, sometimes glandular, spreading-branching; leaves 4–6 cm wide, orbicular, deeply (more than three-fourths) dissected, the lower into 5–7 lobes, the upper into 3–5, the lobes nearly rhombic and cut into 3–5 ovate or lanceolate lobules or teeth. Peduncles 5–15 cm long, axillary, bearing 2 pedicels 2–4 cm long, spreading in fruit, peduncles and pedicels pubescent, sometimes glandulose; bracts lanceolate, scarious; sepals oblong-ovate, 3–5-nerved, pubescent, 8 mm long, shortly mucronate; petals 12–17 mm long, obovate, rounded above, pale, pink-violet, twice as long as sepals, claw short-hairy at base; filaments at 44 dilated part, ciliate for nearly half; fruit beak-shaped, 3 cm long, with smooth short-hairy styles. Fl. May–June, Fr. June–July. (Plate III, Figure 1.)

Flooded meadows in the steppe and semi-desert zones, grassy banks of valley rivers and lakes, often solonchik meadows; desert zone, gardens and irrigation ditches, mountainous regions, lower mountain belt, especially near water, up to the woody-shrubby belt with preference also for moist habitats. — European part: V.-Kama (S. Urals), M. Dnp. (except N.), V.-Don (S.), Transv. (S.), Bes., Bl., Crim. (N.), L. Don, L. V.; Caucasus: Cisc., Dag., W. Transc. (near Ani and Sarykamys in former Kars district), E. and S. Transc., Tal.; W. Siberia: U. Tob, Irt., Alt.; Centr. Asia: all localities except for Kara-Kum and Kyzyl-Kum, from where it has not been reported. Gen. distr.: Centr. Eur. (Transylvania), Arm.-Kurd., Iran., Dzu.-Kash. Described from S. Altai, probably from Zalesov's collections. Type in Berlin.

Note. The Caucasian specimens are interesting because of their unusual features: dense, appressed and short pubescence at the upper part of young plants; long narrow sepals (12–14 mm long) almost as long as the petals, with mucro one-half to one-third as long as the sepal; leaf lobules narrower; more robust and erect plants. These features are strikingly expressed in plants from the Lake Sevan district.

Forms of this species from Zailiiski Ala-Tau, which are distinguished by their very xeromorphic habit and apparently being typical for such localities, were named in the herbarium of the Kazakhstan Academy of Sciences as *G. alatavicum* M. pop (ined.)

35. *G. saxatile* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 177; Ldb. Fl. Ross. I, 785. — *G. collinum* γ . *saxatile* Rgl. in Tp. B. C. V. (1877) 252; Knuth in Pflzr. 53 Heft, 187. — *G. collinum* ξ . *alpinum* Rgl. ibid. 253; Kom. in Tr. SPb. Obshch. Est. XXVI, 150; Knuth, ibid. — *G. candidum* Kom. ibid. 151 — *G. collinum* var. *candidum* (Kom.) B. Fedtsch. in Tr. B. S. XXIII, 2 (1904) 509. — *G. Regelii* Nevski in Tr. Bot. Inst. AN SSSR, ser. 1, IV (1937) 304.

Perennial; rootstock robust, bi- and tricipital; stems 5–7 cm high or plant completely acaulescent or almost so, appressed-hairy, sometimes glandulose above; leaves nearly all radical, shortly-appressed-hairy, petioles 8 cm long, blades orbicular, hairy above, subglabrous beneath, canescent, shallowly 5-fid, lobes broad, 3-fid into cuneate-obovate, usually acuminate lobules. Peduncles 10 cm long, sometimes glandulose above; bracts lanceolate, free, squamiform; pedicels 1–2 cm long, glandulose, spreading; declinated; flowers usually 1–2 on peduncle; sepals 6–8 mm long, 3–6-nerved, scarious at margin, with short awn, one-sixth to one-
45 eighth as long as sepal[?]; pubescent; petals pale or bright blue-violet, sometimes white (var. *candidum* (Kom.) B. Fedtsch.), 1.5–2 cm long, short-clawed; column long-beaked, usually short-hairy or glandular. Fl. July, Fr. August. (Plate III, Figure 2.)

Alpine and subalpine meadows of low mountains, sometimes descending to upper zone of woody-shrubby vegetation belt. — Centr. Asia: Dzu.-Tarb., T. Sh., Pam.-Al. (predominantly west?), Mtn. Turkm. (Chapan-Dagh). Gen. distr.: Dzu.-Kash. Described from Dzungarian Ala-Tau alpine belt. Type in Leningrad.

Note. Due to lack of material the status of *G. saxatile* is still unclarified. It is possible that plants of high mountain Kopet Dagh might belong to this taxon.

36. *G. meeboldii* Briquet in Ann. Cons. et Jard. Bot. Genève, XI–XII (1908) 184. — *G. grandiflorum* Edgew. in Trans. Linn. Soc. XX (1846) 42, non L.; Knuth in Pflzr. 53 Heft, 187, excl. var. — *G. collinum* f. *intermedia* Kom. in Tr. SPb. Obshch. Est. XXVI (1896) 152.

Perennial; similar to the preceding species from which it differs by the distinctly developed stems, 15–30 cm high, often erect; not only peduncles and pedicels obviously pubescent, but also petioles, leaves and upper part of stem; very distinctly short pedicels (ca. 1 cm) owing to which, and also because of the relatively short peduncles and some branches of the stem, the flowers are crowded, looking altogether like an inflorescence; sepals obtuse, terminating in short awn, not gradually acuminate; flowers large; petals usually lilac with purple-tinged veins; style long; leaves like those of *G. saxatile*. Fl. June–July, Fr. July.

Mixed herb and grass subalpine belt and upper part of shrub belt, alpine meadows. — Centr. Asia: Pam.-Al. (except for western part, especially in Darvaza, Shugnan and Peter the First Range). Gen. distr.: Ind.-Him. (NW), Dzu.-Kash. (W. Tibet). Described from W. Tibet. Type in Geneva.

37. *G. ferganense* Bobr. n. sp. in Addenda XIII, 713. —

Perennial; plant (15)25–40 cm high, much resembling *G. meeboldii* Briquet but distinctly differs in habit, typically furcate-branching from middle of stem. Rootstock thick, descending, sometimes branching above, producing 1–2 stems and 3–5 radical leaves; radical leaves with 15–25 cm long petioles, densely pubescent above and sparsely beneath, with short recurved hairs, densely short-appressed hairy especially along nerves, blades 4–6 cm wide, pentagonal-orbicular, shallowly parted for slightly more than half into 5 broad obovate or rhombic lobes, lobes broadly incised-
46 dentate, 3-fid in upper half; cauline leaves pentagonal, the upper smaller,

shallowly incised, subtrilobate. Peduncles short; pedicels not more than 1 cm, thus the flowers crowded in the upper part of the stem as if forming an inflorescence; flowers 3–4 cm in diameter; petals bright in color. July. (Plate III, Figure 3.)

This plant differs from *G. meeboldii* by its shallowly incised, sublobate, nearly pentagonal leaves with broadly incised-dentate lobes, and from *G. saxatile* Kar. et Kir. and *G. collinum* Steph. by the crowded flowers above the stem as if forming an inflorescence.

Forest and subalpine belts. — Centr. Asia: T. Sh. (N. Fergana–Chatkal and Fergana ranges). Endemic. Described from Aflatun pass. Type in Leningrad.

Section 8. *STRIATA* Knuth in Engl. Pflzr. 53 Heft (1912) 47, 188. — Blades of radical leaves subquinquepartite, cauline leaves tripartite; lobes ovate or ovate-rhombic.

38. *G. gracile* Ldb. in Bull. Acad. Petrop. II (1837) 314; Boiss. Fl. or. I, 875; Voron. in Mat. Fl. Kavk. III, 7, 19; Knuth in Pflzr. 53 Heft, 190; Grossg., Fl. Kavk. III, 6. — *G. trilobum* C. Koch in Linnaea, XV (1841) 716. — *G. gracile* var. *trilobum* Boiss. Fl. or. I (1867) 876. — *G. gracile* var. *glabriusculum* Alb. Prodr. Fl. Colch. (1895) 45. — *G. nodosum* Ldb. Fl. Ross. I (1842) 462, 784, non L. — Exs.: Pl. or. exs. No. 188.

Perennial; rootstock thick, long; stems 45–80 cm high, nearly simple, covered mostly in lower part with recurved hairs, with shorter spreading hairs above, rarely subglabrous; lower leaves long-petioled, the upper and middle leaves sessile, opposite, blades green above, appressed-hairy, grayish beneath, hairy especially along nerves; blades of lower leaves 5-partite for more than half, the upper trilobate, lobes ovate, acuminate, shallowly incised-dentate above. Inflorescence very loose, racemiform; peduncles 3–10 cm long, with short spreading, sometimes glandular hairs; bracts linear, herbaceous, pubescent; pedicels 1–4 cm long, thin, pubescent; flowers broadly campanulate; sepals ca. 8 mm long, ovate-oblong, sometimes long-hairy along nerves and at margins, with 2–3 mm long awn; petals 17–18 mm long, cuneate, emarginate; filaments ciliate beneath; carpels white-hairy. Fl. June–July, Fr. July. (Plate II, Figure 5.)

49 Mountain forests, from the low mountains to the subalpine belt. — Caucasus: Cisc. (Oshten, upper reaches of Malaya Laba), W. and E. Transc. (Borzhomi district). Gen. distr.: Bal.-As. Min. (only in Lazistan). Described from Khircha Mountain in Abkhazia. Type in Leningrad.

39. *G. wilfordii* Maxim. in Mém. Biol. X (1880) 614, pl. jap. excl.; Ej. in Bull. Ac. Sc. Pétersb. XXVI, 453; Kom., Fl. Man'chzh. II, 646; Knuth in Pflzr. 53 Heft, 191.

Perennial; stems 30–60 cm high, erect, sometimes prostrate, sometimes even rooting, spreading-hairy; petioles and peduncles densely covered with short recurved hairs; stipules subulate, free; leaves appressed-hairy above and only along nerves beneath, blades triangular-reniform,

(47)

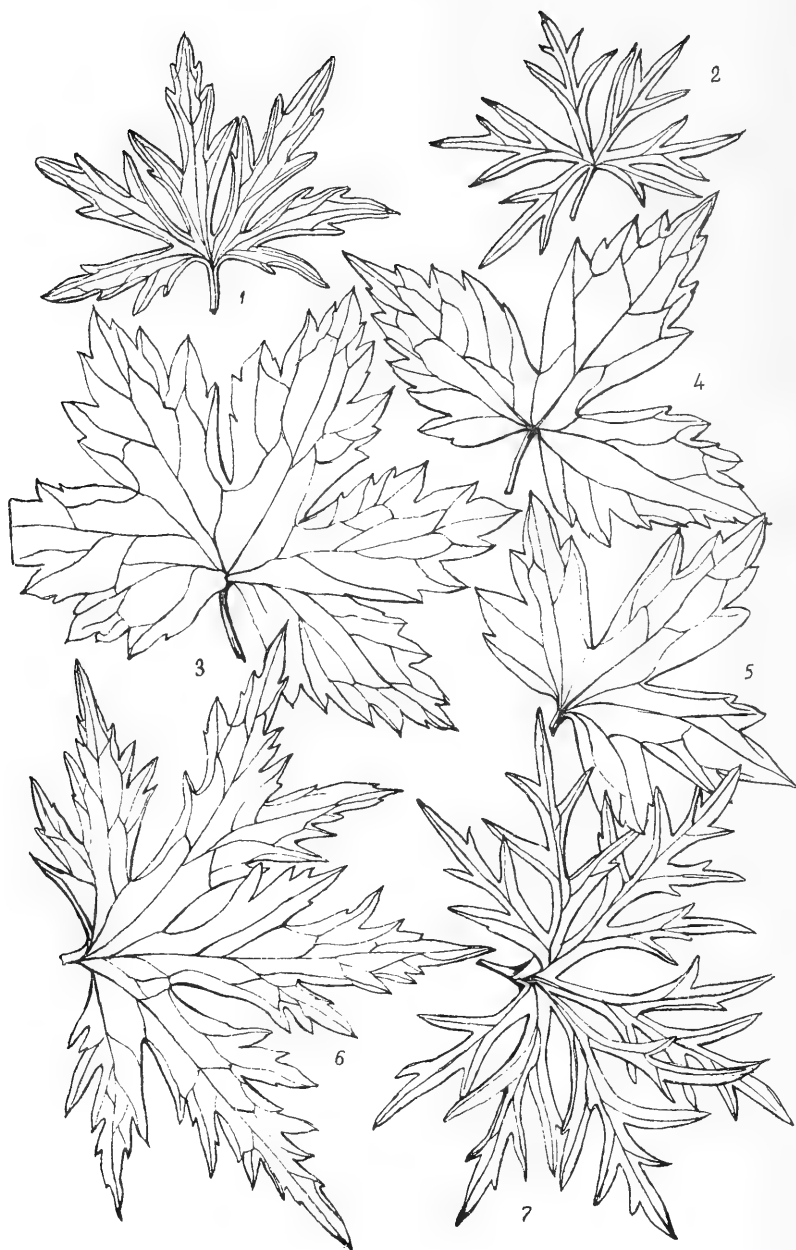


PLATE IV. 1 — *Geranium sieboldii* Maxim.; 2 — *G. dahuricum* DC.; 3 — *G. eriostemon* Fisch.; 4 — *G. wilfordii* Maxim.; 5 — *G. vlassovianum* Fisch.; 6 — *G. erianthum* DC.; 7 — *G. soboliferum* Kom.

3-partite, the lower nearly 5-partite, lobes ovate, acuminate, incised-serrate; sometimes lateral lobes of median cauline leaves incised outside as well. Peduncles 2-flowered, hardly longer than leaves, spreading in fruit; sepals ovate, acuminate; mucronate; petals pale pink, ca. 7 mm long, spatulate, hardly longer than sepals, pubescent inside at base; filaments pubescent at the dilated part, longer than stigmas; fruit smooth, bristly-hairy, column beak-shaped, scabrous; seeds pitted-dotted.

Fl. July, Fr. August. (Plate IV, Figure 4.)

Flooded forests, forest edges, shrubby formations. — Far East: Ze.-Bu. (S.), Uss. **Gen. distr.:** Manchuria, Korea, Hupeh province. Described from the Pacific, 40–45° N, from the Wilford collections. Type in London, cotype in Leningrad.

Section 9. PYRENAICA Knuth in Engl. Pflzr. 53 Heft (1912) 46, 152, p. p. — Leaves deeply dissected, but very rarely nearly to base, orbicular or reniform-orbicular, obtuse, 5–7-angled, perennials.

40. *G. albanum** M. B. Fl. taur.-cauc. II (1808) 137; III, 455; Ldb. Fl. Ross. I, 408; Boiss. Fl. or. I, 879; Shmal'g., Fl. I, 194; Voron in Mat. Fl. Kavk. III, 7, 24; Knuth in Pflzr. 53 Heft, 154; Grossg., Fl. Kavk. III, 4. — *G. cristatum* Stev. in Mém. Soc. Nat. Mosc. IV (1813) 50; DC. Prodr. I, 643; Rupr. Fl. Cauc. 274. — Exs.: Herb. Fl. Cauc. No. 473.

Perennial; rootstock short, with a tuft of fusiform-swollen roots; stems 1–2, slender, ascending, 20–50 cm high, covered with long white spreading hairs, weakly branching; lower leaves with long hairy petioles, the upper
50 with longer or shorter petioles; blades of leaves 6–8 cm wide, reniform-orbicular, deeply cordate at base, the lower 7-partite, the smaller upper 5-partite, lobes cuneate, 3-fid and deeply dentate, appressed-hairy, especially above; stipules pale, nearly scarious, lanceolate. Peduncles axillary, longer than leaves, pubescent, 4–10 cm long, each with 2 pedicels; bracts linear, scarious; pedicels 3–6 cm long, pubescent, declinate spreading post anthesis; sepals lanceolate, 8–10 mm long, with 1 mm long awn, pubescent at margin and nerves; petals 14–20 mm long, obovate, emarginate, purple; filaments glabrous; carpels transversely rugose and dorsally pectinate-dentate, pubescent, beak subfiliform, pubescent. Fl. April–May, Fr. May–June. (Plate III, Figure 6.)

Forest edges amid shrubby formations in lower forest belt. — Caucasus: Dag., E. Transc., Tal. **Gen. distr.:** Iran (NW). Described from Bakir district near Signakh. Type in Leningrad.

41. *G. pallens* M. B. Fl. taur.-cauc. II (1808) 138; Ldb. Fl. Ross. I, 471; Voron. in Mat. Fl. Kavk. III, 7, 27; Grossg., Fl. Kavk. III, 5. — *G. asphodeloides* β . *hispidum* Boiss. Fl. or. I (1867) 878; Knuth in Pflzr. 53 Heft, 156. — Exs.: Herb. Fl. Cauc. No. 228; Pl. or. exs. No. 159.

Perennial; rootstock short, with tuft of swollen fibrous roots; stems usually 2, ascending, weakly branching, with softly hispid, sometimes with

* From Albania, the Latin name for the Caspian province of the Caucasus, part of which is in the present-day Daghestan.

glandular hairs above; leaves orbicular, the lower usually 7-lobed, the upper 5-lobed, lobes cuneate, deeply incised-dentate; stipules 6–8 mm long, linear or linear-setiform especially in upper leaves. Peduncles axillary, several times longer than leaves, short-hispid, glandular-hairy; bracts linear, pale lilac, scarious; pedicels paired, 1–3 cm long, spreading in fruit; flowers campanulate; sepals lanceolate, acuminate, 7–10 mm long, with short awn, dorsally lilac, short-hispid; petals obovate, narrow, 12–17 mm long, 5–6 mm wide, rounded above, entire, pale pink or pale purple, nerves more brightly colored; carpels shortly spreading-hairy, beak attenuate, style colored above. Fl. June, Fr. July.

Shady places in moist grass plots near water. — Caucasus: W. Transc. (former Artvin district, Sochi, Kutaisi), E. Transc. (Akhaltikh, Bakuriani). Gen. distr.: As. Min. Described from W. Georgia. Type in Leningrad.

42. *G. tauricum* Rupr. in Mém. Ac. Imp. Sc. Pétersb. sér. VII, t. XV, 2 (1869) 268. — *G. collinum* M. B. Fl. taur.-cauc. III (1818) 455, non Steph. — *G. asphodeloides* subsp. I. — *G. asphodeloides* Burm. s. str. ex Woron. in Mat. Fl. Kavk. III, 7 (1907) 27.

- 51 Perennial; resembling the preceding species, differing by stems and branches being covered above with few recurved and appressed hairs; stipules lanceolate-linear, 4–5 mm long; lobes of leaf wider; sepals appressed-hairy and more brightly colored; petals obovate and wider, 15–17 mm long, 8–10 mm wide, sometimes slightly emarginate above. Fl. May, Fr. June. (Plate III, Figure 5.)

Shrubby formations, forests and slopes. — European part: Crim. (forests of S. Crimea, mostly along southern shores). Endemic. Described from S. Crimea. Type in Leningrad.

Note. Following Ruprecht, we treat the Crimean material as a separate endemic species, although its diagnostic distinctions from the original *G. asphodeloides* Burm. has been reported from the adjacent region of Dobrudja.

Section 10. ROTUNDIFOLIA Gams in Hegi, III. Fl. IV, 3 (1925) 1668. — Annuals and biennials; leaves orbicular-reniform; petals emarginate, rarely entire.

43. *G. pyrenaicum* Burm. f. Sp. Geran. (1759) 27; L. Mant. (1767) 91, (1771) 257; M. B. Fl. taur.-cauc. II, 138; Ldb. Fl. Ross. I, 469; Shmal'g., Fl. I, 192; Voron. in Mat. Fl. Kavk. III, 7, 56; Knuth in Pflzr. 53 Heft, 152. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 192. — Exs.: Callier, It. taur. tert. No. 570; Fl. exs. austro-hung. No. 3216; Herb. Norm. No. 5018.

Biennial and perennial; root vertical, brown, multicipital; stems 2–5, ascending, branching above, 20–60 cm high, covered with short and long soft hairs, often glandular above; radical leaves many, with 6–15 cm long petioles, reniform-orbicular, 3–5 (to 8) cm wide, usually palmately 7-partite, lobes broadly cuneate or obovate, usually obtuse and incised-crenate above;

cauline leaves opposite, short-petioled; uppermost leaves small, sessile; all leaves pubescent on both sides. Peduncles axillary, thin, longer than leaves, spreading in fruit, glandular-hairy; bracts ovate-lanceolate, dry-coriaceous; pedicels glandular-hairy, drooping after flowering and bearing upturned fruits; sepals oblong or oblong-ovate, obtuse, with short appressed
52 and sometimes glandular hairs, very shortly awned and obsoletely veined; petals violet, 7–11 mm long, obovate or deeply 2-lobed, with a narrow notch; beak thin, gradually attenuate, carpels appressed-hairy; seeds glabrous. Fl. May–September, Fr. June–October. (Plate III, Figure 4.)

Shady places, shrubby and other formations. — European part: sometimes as an introduced plant into many areas up to Leningrad and Moscow in the northeast; common and widely distributed in the Crimea. **Gen. distr.:** Atl., Centr. and S. Europe, W. and E. Med. Described from the Pyrenees. Type in the Linnaean Herbarium.

44. *G. depilatum* (Somm. et Lev.) Grossh. in Grossh. et Schischk. Sched. ad Herb. Pl. or. exs. f. XIV (1928) 37; Grossg., Fl. Kavk. III, 5. — *G. pyrenaicum* var. *velutinum* Boiss. et Buhse, nom. nud. (1860). — *G. pyrenaicum* var. *depilatum* Somm. et Lev. in Tr. B. S. XVI (1900) 102; Voron. in Mat. Fl. Kavk. III, 7, 57. — Ic.: Dechy M. Kauk. III, tab. XIV. — Exs.: Pl. or. exs. No. 341.

Biennial and perennial; in contrast to the original *G. pyrenaicum* L. these plants are densely covered with short hairs mixed with short glandular ones (in the Crimean plants the hairs are longer and more spreading). Long and soft hairs, typical of the Crimean and W. European plants, are absent or found very occasionally in the Caucasian specimens.

Forests, shrubby formations, shady places. — Caucasus: everywhere. **Gen. distr.:** As. Min. Described from Rekom (C. Caucasus). Type in Budapest.

Note. There are no other characters distinguishing the Caucasian population from *G. pyrenaicum* and hence the specific rank appears to us to have been preserved mainly due to tradition.

45. *G. pusillum* Burm. f. spec. Geran. (1759) 27; M. B. Fl. taur.-cauc. II, 139; III, 456; Ldb. Fl. Ross. I, 470; Boiss. Fl. or. I, 880; Shmal'g., Fl. I, 192; Voron. in Mat. Fl. Kavk. III, 7, 63; Knuth in Pflzr. 53 Heft, 48; Grossg., Fl. Kavk. III, 3. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 190, fig. 4877. — Exs.: G. R. F. No. 1598; H. F. A. M. No. 428; Fl. Pol. exs. No. 152; Pl. Finl. exs. Nos. 785, 2002.

Annual or biennial; stems 10–30(50) cm high, usually few, ascending, thin, branching, sometimes with short hairs above mixed with glandular ones; radical leaves with 4–8 cm long petioles, blades orbicular, 1–3 cm
55 wide, dissected for three-fourths into 5–7 cuneate, rounded above and short-incised lobes; lower cauline leaves slightly larger, upper leaves small, 3–5-fid with narrow lobes; all leaves with soft short appressed hairs, especially beneath. Peduncles 1–3 cm long, short-hairy, bearing 2 pedicels; pedicels pubescent, sometimes with glandular hairs, spreading in fruit, with fruits upturned; flowers ca. 3.5 mm long; sepals ovate-lanceolate, pubescent; petals hardly as long as or slightly longer than calyx lobes, oblong-obcordate, finely ciliate below, pale violet or pink; carpels smooth, appressed-hairy, beak glandular-hairy. Fl. May–June, Fr. June–July. (Plate V, Figure 4.)

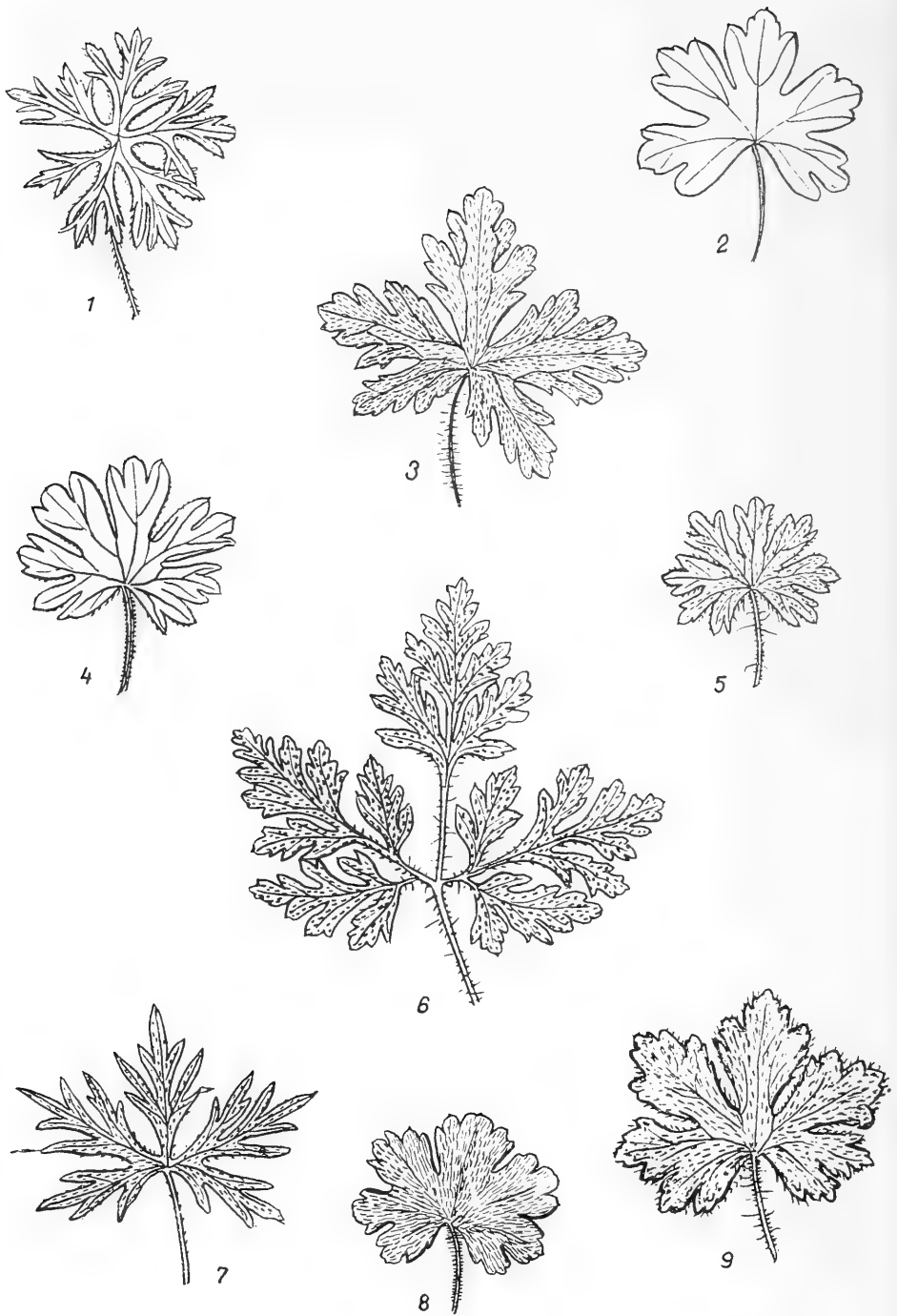


PLATE V. 1—*Geranium dissectum* L.; 2—*G. lucidum* L.; 3—*G. divaricatum* Ehrh.; 4—*G. pusillum* Burm. f.; 5—*G. molle* L.; 6—*G. robertianum* L.; 7—*G. columbinum* L.; 8—*G. rotundifolium* L.; 9—*G. bohemicum* L.

Field edges and roadsides, weedy places, gardens, shrubby formations. — European part: Balt., Lad.-Ilm. (W.), U. Dnp., U. V., V.-Kama (to Ufa in the east), U. Dns., M. Dnp., V.-Don, Bes., Bl., L. Don, Crim.; Caucasus: everywhere (very rarely in W. Transc. and Tal.); Centr. Asia: rarely in all regions except for high mountain areas. **Gen. distr.:** Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Arm.-Kurd., Iran. Described from England.

46. *G. molle* L. Sp. pl. (1753) 682; M. B. Fl. taur.-cauc. II, 139; Ldb. Fl. Ross. I, 469; Boiss. Fl. or. I, 822; Shmal'g., Fl. I, 192; Voron. in Mat. Fl. Kavk. III, 7, 65; Knuth in Pflzr. 53 Heft, 57; Grossg., Fl. Kavk. III, 3. — *G. argenteum* Luce, Prodr. Fl. osil. (1823) 236. — *G. lejo-caulon* Ldb. Fl. Ross. I (1842) 470. — *G. molle* var. *caucasicum* Rgl. in sched. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 191, fig. 4879. — Exs.: Fl. Stir. No. 452; Pl. Finl. exs. No. 787.

Annual or biennial; stems usually 3–5, 10–30(40) cm high, sparsely spreading-hairy, sometimes with glandular hairs above; stipules broadly ovate, dry-coriaceous, brownish; radical leaves with long petioles spreading-long-hairy above, blades orbicular-reniform, 2–3(4) cm wide, dissected for two-thirds into 7–9 obovate lobes, incised above into 3–5 obtuse lobules; lower cauline leaves opposite, with shorter petioles and narrower lobes, the upper leaves smaller; all leaves with appressed soft-sericeous hairs on both sides. Peduncles glandular-pubescent; spreading in fruit, 1–3 cm long, with 2 shorter pedicels; flowers 4–7 mm long; sepals ovate, short-awned, long-hairy, 4–5 mm long; petals longer than sepals, 5–7 mm, obcordate, pale purple or pink-violet, ciliate at base; filaments glabrous; carpels rugose, beak with glandular hairs. Fl. April–May, Fl. May–June. (Plate V, Figure 5.)

56 Dry meadows, roadsides, edges of fields, pastures. — European part: Balt. (Ezel and Moon islands), U. Dnp. (extreme west), U. Dns., Bes., Crim.; Caucasus: in all plains and foothills, especially in Dag., E. Transc. and Tal. **Gen. distr.:** Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Iran (NW). Described from Centr. Europe. Type in London.

Note. The original *G. lejocaulon* Ldb. is an extremely poor specimen with a glabrous stem; otherwise it is similar to *G. molle* L. We have found it necessary to include Ledebour's specimen in the synonymy because in Talysh, from where it was described, occurs the typical *G. molle* L.

47. *G. rotundifolium* L. Sp. pl. (1753) 683; Ldb. Fl. Ross. I, 470; Boiss. Fl. or. I, 880; Shmal'g., Fl. I, 192; Voron. in Mat. Fl. Kavk. III, 7, 61; Knuth in Pflzr. 53 Heft, 55; Grossg., Fl. Kavk. III, 3. — *G. viscosum* Gilib. Fl. Lithuan. II (1785) 177. — Ic.: Engl. Bot. tab. 147; Rchb. Ic. Fl. Germ. III, tab. 190. — Exs.: H. F. A. M. No. 429, a, b; Fl. Pol. exs. No. 328.

Annual; stems few, ascending, 20–40 cm high, branching, densely covered with short soft hairs mixed above with glandular ones; stipules narrowly triangular, red-brown; radical leaves many, rosetted, dying early, orbicular-reniform; lower cauline leaves larger, 5 cm wide, also orbicular-reniform, with long petioles covered with spreading and glandular hairs, blades shortly

soft-hairy on both sides, cut for less than half into 5–7 broad obovate lobes, lobes shallowly cut into 3–4 rounded teeth. Peduncles up to 5 cm long, bearing two 1–2 cm long pedicels, spreading in fruit; sepals elliptic, acuminate, 3–5-nerved, pubescent, short-awned; petals 5–7 mm long, nearly twice as long as sepals, cuneate, entire, pale lilac or pink; carpels pubescent, smooth, beak with glandular hairs, attenuate above; seeds finely dotted. Fl. May–June, Fr. June. (Plate V, Figure 8.)

Shrubby formations, slopes, gardens, weedy places. — European part: Balt., Lad.-Ilm. (Leningrad, introduced), U.Dns., M.Dnp., Crim.; Caucasus: everywhere except for the high mountain areas; Far East: Uss. (Vladivostok, introduced); Centr. Asia: Balkh., Dzu-Tarb. (foothills of Dzungarian Ala-Tau), Mtn. Turkm., Syr D., Pam.-Al., T. Sh. Gen. distr.: Atl. and Centr. Eur., W. and E. Med., Bal.-As. Min., Iran. Described from W. Europe. Type in London.

Section 11. *DIVARICATA* Rouy, emend. Gams in Hegi, III. Fl. IV, 3 (1925) 1669, 1697. — Stems with spreading, sometimes recurved hairs (*G. sibiricum*); blades of leaves quite deeply cut into 3–5 rhombic lobes; carpels strongly pubescent. Annuals and biennials.

48. *G. divaricatum* Ehrh. Beitr. VII (1792) 164; M. B. Fl. taur.-cauc. II, 188; Ldb. Fl. Ross. I, 473; Boiss. Fl. or. I, 881; Shmal'g., Fl. I, 194; Voron. in Mat. Fl. Kavk. III, 7, 73; Knuth in Pflzr. 53 Heft, 57; Grossg., Fl. Kavk. III, 2; Kryl., Fl. Zap. Sib. VIII, 1833. — Ic.: W. et K. Descript. pl. Hung. II, tab. 123; Rchb. Ic. Fl. Germ. III, tab. 180. — Exs.: G. R. F. No. 1607; H. F. A. M. No. 427; Fl. Ital. exs. No. 603.

Annual; stems 20–60 cm high, spreading-branching, covered like petioles and peduncles with long thin spreading hairs and short glandular ones; stipules pale, scarious, triangular-lanceolate; lower cauline leaves larger, 3–10 cm in diameter, pentagonal, palmately dissected nearly to base into 5 rhombic, largely and obtusely incised-dentate lobes; all blades appressed-hirsute, sometimes with glandular hairs at margin. Peduncles 1.5–5 cm long, with 2 pedicels spreading post-anthesis; bracts linear-lanceolate, long-hairy; sepals ovate, short-awned, hispid dorsally and at margins; petals slightly longer than sepals, 6–8 mm long, pale pink with more brightly colored nerves, cordate or subcuneate, emarginate; carpels transversely rugose, hairy above and along wrinkles, beak rough-hairy; seeds nearly smooth. Fl. May–June, Fr. June–July. (Plate V, Figure 3.)

Shrubby formations, forest edges, sometimes among rocks, shady places, often in parks and gardens, or as a weed. — European part: U. V. (Moscow), U. Dnp. (Mozyr district), M. Dnp., U. Dns., Bes., Bl., Crim. (known only from the literature), L. Don, L. V. (Ergeni); Caucasus: all regions except for the high mountains; W. Siberia: U. Tob. (Mugodzhar), Irt. (Karkaralinsk), Alt. (along the Irtysh River); Centr. Asia: Balkh., Dzu.-Tarb., Mtn. Turkm., Syr D., Pam.-Al. (west of Zaravshan and Gissar ranges), T. Sh. Gen. distr.: Centr. and Atl. Eur., W. and E. Med., Bal.-As. Min., Iran; Dzu.-Kash. (Kuldja). Described from Hungary.

49. *G. sibiricum* L. Sp. pl. (1753) 683; M. B. Fl. taur.-cauc. II, 133; III, 454; DC. Prodr. I, 639; Ldb. Fl. alt. III, 227; Ej. Fl. Ross. I, 459; Turcz. Fl. baic.-dah. I, 253; Boiss. Fl. or. I, 879; Maxim. in Bull. Acad. Pétersb. XXVI, 455; Shmal'g., Fl. I, 195; Kom., Fl. Man'chzh. II, 645; Voron. in Mat. Fl. Kavk. III, 7, 60; Knuth in Pflzr. 53 Heft, 195; Grossg., Fl. Kavk. III, 4. — *G. acrocarpum* Ldb. Fl. Ross. I (1842) 471. — *G. sibiricum* ssp. *eu-sibiricum* Gams in Hegi, III. Fl. IV, 3 (1925) 1695. — *G. ruthenicum* Uechtr. in Ö. B. Z. XXIII (1873) 335. — *G. sibiricum* ssp. *ruthenicum* (Uechtr.) Gams, l. c. p. 1696. — Ic.: Gmel. Fl. Sib. III, tab. 67; Hegi, III. Fl. IV, 3, fig. 1637.

58 Perennial; annual or biennial; stems usually 1, rarely 2–3, prostrate or ascending, strongly branching, 20–60 cm high, covered mainly above with spreading or even recurved hairs, usually simple not glandular; stipules lanceolate, long-acuminate, 8 mm long, coriaceous; radical leaves dying early, 5–7-lobed; cauline leaves opposite, with 1–8 cm long petioles, blades pentagonal, 2–5 cm wide, very deeply dissected into 5 rhombic, acuminate lobes large-toothed above; upper leaves 3-lobed. Peduncles generally 1-flowered, very rarely bearing 2, post anthesis spreading below, arcuately curved above; flowers 5–7 mm long; sepals ovate-elliptic, 3-nerved, hairy; petals about as long as sepals, 4–7 mm long, 2–3 mm wide, obovate, slightly emarginate, ciliate at base, white or pale pink; fruits 2 cm long, dorsally stiff-hairy; seeds finely dotted in lines. Fl. June–July, Fr. July–September.

Weeds in parks, streets, and buildings, pastures, fallow fields, edges of fields, banks of rivers and lakes, sometimes at forest edges, often in burned-out areas in forests, roadsides. — European part: Balt. (S. in Vilna district), U. V., V.-Kama (from Chardym to the north), M. Dnp., V.-Don, Transv. (E.); Caucasus: W. and E. Cisc., Dag., E. Transc. (southern slopes of the Main Range, rare), W. Transc. (Tsebel'da); W. Siberia: Ob (to Berezov in the northwest), U. Tob., Irt., Alt.; E. Siberia: Ang.-Say., Dau., Lena-Kol. (Yakutsk district in the north); Far East: Ze.-Bu., Uda, Uss., Sakh.; Centr. Asia: Balkh. (Zaisan and Taldy-Kurgan), Dzu.-Tarb., T. Sh. (Alma-Ata), Pam.-Al. (introduced into Zeravshan and Darvaza). Gen. distr.: Centr. Eur., Dzu.-Kash., Mong., Jap.-Ch., introduced into N. America. Described from "Siberia." Type in London.

Note 1. *G. sibiricum* appears as an introduced plant or even a weed, and apparently never as an obligate component of the natural vegetation throughout its enormous distribution area, which stretches from the Baltic area to the Pacific Ocean and from the Northern Urals to Transcaucasia and Darvaza. Because it is so widespread in W. Siberia its natural habitat might be there, yet it is usually found in other primary habitats with interrupted vegetation cover. Raising *G. ruthenicum* into a separate species, as Uechtriz did, is unjustified inasmuch as the enumerated forms do not have a definite area or sufficient morphological distinctions. Uechtriz pointed out the somewhat different habit and the degree of pubescence as distinctive, but the variable pubescence was already known to Bieberstein (l. c.), who reported that the Caucasian specimens were less
59 pubescent than the Siberian. It is interesting to note that the European plants blossom one month earlier than the Siberian, as reported by Gams (l. c.).

There is no doubt that the problematic *G. acrocarpum* Ldb. should be included here. Meyer's original specimens are inadequate, representing the young shade-form, with peduncles bearing two pedicels. Such pedicels are sometimes observed in shade-forms in moist habitats.

Note 2. According to M. G. Popov, Uechtriz was quite right in distinguishing the two allied species which he observed in (simultaneous) cultivation. The western species, which is a ruderal plant, occurs in the Visla basin and to the west; its flowers are densely pink or pink-violet and the vegetative parts are villous-hairy. The eastern species is a taiga weed and is distributed in Siberia from where it had been described by Linnaeus. Uechtriz was wrong only in referring to the western species as *G. sibiricum* in spite of Linnaeus' description (white flowers, growing in Siberia), and Linnaeus' real species bears the name *G. ruthenicum* Uechtr. Thus the western species remained unnamed. Popov proposed the name *G. europaeum* M. Pop. The characters of this species are as follows: flowers white or pale pink; sparsely pubescent plants with short appressed hairs, partly becoming dense and gray. The distribution areas of the two species are disjunctive.

50. *G. bohemicum* L. Amoen. Acad. IV (1760) 323; Ldb. Fl. Ross. I, 473; Shmal'g., Fl. I, 195; Voron. in Mat. Fl. Kavk. III, 7, 74; Knuth in Pflzr. 53 Heft, 56; Grossg., Fl. Kavk. III, 2. — Ic.: Rchb. Ic. Fl. Germ. III, tab. 188; Hegi, III. Fl. IV, 3, 1697. — Exs.: G. R. F. No. 2518, a, b.

Annual or biennial; stems 20–60(80) cm high, usually branching, covered with glandular and long soft simple hairs; stipules lanceolate, densely glandular; radical leaves with 4–10 cm long petioles, blades 2–6 cm wide, dissected for more than half into 5–7 deltoid lobes soft-hairy at both sides, lobes cut into rounded teeth; lower cauline leaves larger, with 3–5 strongly incised-dentate lobes. Fruiting pedicels erect; sepals broadly elliptic, 4–6 mm long, elongating in fruit to 7–10 mm, with 1–3 mm long awn, 3–5-nerved, glandular; petals obovate, 8–12 mm long, bluish-violet; carpels smooth, dark, black hairy; beak thick, ca. 2 mm long, glandular, attenuate above; seeds finely dotted in lines. Fl. June, Fr. July. (Plate V, Figure 9.)

Burned-out areas in forests, felled areas, coal pits, burned heaps, sometimes as a weed along forest paths. — European part: Dv.-Pech. (Vologda), Balt., Lad.-Ilm. (especially in the Leningrad and Pskov regions), U. V., V.-Kama (Zilair), U. Dnp., M. Dnp., V.-Don, Crim. (nature reservation); 60 Caucasus: Cisc. (Stavropol', State nature reservation), E. Transc. (Abas-tuman, Borzhomi). Gen. distr.: Centr. Eur. Described from Bohemia (reported as the type locality). Type in London.

Note. The affinity of this species to temporary habitats (burned-out areas in forests, felled and burned heaps), its disappearance and reappearance for many years, make its distribution inconstant and undefined. For this reason it was given the German name *G. gypsum*.

Section 12. *TUBEROSA* Boiss Fl. or. I (1867) 869. — Plants usually having an underground part; moniliform with 2–3 tubers. Petals short-clawed, ciliate below like filaments. Carpels smooth.

The 6–8 species included here belong to one species-group and are distributed from Morocco and Spain to Dzungaria.

51. *G. tuberosum* L. Sp. pl. (1753) 680; Ldb. Fl. Ross. I, 460 p.p.; Shmal'g., Fl. I, 194; Voron. in Mat. Fl. Kavk. III, 7, 11; Knuth in Pflzr. 53 Heft, 96, excl. var. β . et γ .; Grossg., Fl. Kavk. III, 4. — *G. radicum* M. B. Fl. taur.-cauc. II (1808) 134, III, 454. — *G. tuberosum* var. *genuinum* Boiss. Fl. or. I (1867) 873; O. Ktze. in Tr. B. S. Kh., 1 (1887) 177. — *G. tuberosum* var. *radicatum* O. Ktze. l.c. — Ic.: Sibth. et Sm. Fl. Gr. tab. 659; Rchb. Ic. Fl. Germ. tab. f. 4885. — Exs.: Schulz, Herb. Norm. No. 840; Fl. cauc. exs. No. 117.

Perennial; underground part moniliform with 3 tubers 1–2 cm long, irregular or ovoid-angular, brown; stems 15–40 cm high, usually few, erect, furcately spreading-branching above, densely covered — especially above — radical leaves usually 1–3(4), with 10–15 cm long hairy petioles; blades 10 cm wide, orbicular-pentagonal, dissected nearly to base into 7–9 lanceolate or ovate-rhombic lobes, lobes deeply pinnatisect into lanceolate lobules (var. *pinnatifidum* Woron.) or incised-dentate (var. *incisodentatum* Woron.), all appressed-hairy, more densely so beneath; cauline leaves (likewise the branching stem) shorter, with shorter petioles; terminal leaves sessile, with sublinear, hardly incised lobes. Peduncles 3–5 cm long, sometimes unobserved; pedicels paired, 1–3 cm long, finely and densely hairy especially above; bracts linear, brown, pubescent; sepals 6–10 mm long, ovate, densely pubescent, lilac, short-awned; petals 12–20 mm long, obcordate, pinkish-lilac, nerves more intensively colored, short-clawed, hairy at base; filaments colored, ciliate below, hardly longer than sepals; carpels and beak densely short-hairy. Fl. April–May, Fr. May. (Plate III, Figure 7.)

61 Shrubby formations, meadows, fields. — European part: Crim., L. Don.(S.); Caucasus: Cisc., Dag., E. and S. Transc. Gen. distr.: W. and E. Med., Bal.-As. Min. Described from S. Europe. Type in London.

52. *G. transversale* (Kar. et Kir.) Vved. in Pavl. Fl. Tsentr. Kazakhst. II (1935) 429. — *G. tuberosum* β . *transversale* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 176. — *G. tuberosum* ssp. *linearilobum* (DC.) Kryl., Fl. Zap. Sib. VIII (1935) 1822. — Exs.: H. F. A. M. No. 69, pro *G. tuberoso*.

Perennial; similar to preceding species, but clearly distinguished by its orbicular radical leaves cut into 7–9 oblong-cuneate lobes, lobes narrow, 2–3-fid into short oblong-linear acuminate confluent lobules; lobes of upper cauline leaves linear; stems with mainly short and a few long hairs; tubers moniliform. Beak of fruit filiform below stigma, appearing attenuate. Fl. April; Fr. May.

Shrubby formations on slopes, meadows in plains, low mountains and foothills. — W. Siberia: U. Tob. (Orsk), Alt. (along the Irtysh River); Centr. Asia: in all regions except for the high mountains and Mtn. Turk. and in Pam.-Al. only in the northwest. Gen. distr.: Dzu.-Kash. Described from Ayaguz in Dzungaria. Type in Leningrad.

53. *G. linearilobum* DC. Fl. Fr. VI (1815) 629; Ej. Prodr. I, 640; Ldb. Fl. Ross. I, 460, p. p.; Voron. in Mat. Fl. Kavk. III, 7, 14; Grossg., Fl. Kavk. III, 4. — *G. tuberosum* M. B. Fl. taur.-cauc. III (1808) 135; III, 454, non L. — *G. tuberosum* var. *linearifolium* Boiss. Fl. or. I (1867) 873; Knuth in Pflzr. 53 Heft, 97. — *G. tuberosum* β . *linearilobum* Schmalh., Fl. I (1895) 194.

Perennial; much like the preceding species, differing by the regular 3-sect lobes of the radical leaves; plant covered with short gray hairs recurved on the stems. Fl. April–May, Fr. May–June. (Plate III, Figure 9).

Steppe slopes, shrubby and steppe formations in semideserts. — European part: Bl. (Mariupol), L. Don (Gundorovka, Ust'-Medveditskaya, Kamyshin, Stalingrad, Krasnoarmeisk), L. V.; Caucasus: Cisc. (E.), Dag., E. Transc. (E.), Tal. Endemic? Described from L. Don. Type in Paris.

Note. It should be pointed out that we propose here only a provisional solution to the naming of this and the preceding species; in the original description of *G. linearilobum* DC., deCandolle gave Siberia as its area whereas in *Prodromus* he reported the Lower Volga and 62 N. Caucasus. This contradiction is due to the authors of the end of the 18th and beginning of the 19th century who referred to the eastern part of European Russia as "Siberia." Under the assumption that the type was from the Lower Volga we are keeping de Candolle's name for the populations of the southeast USSR and E. Caucasus.

If the specimens from Siberia do indeed represent the type of the species (de Candolle's original specimens could have been from the upper reaches of the Irtysh River), then de Candolle's epithet should be adopted for the Central Asian plants and the combination submitted by Vvedenskii should be included in its synonymy. In that event the plants of E. Caucasus and the southeastern part of the European USSR should be renamed. For the western species we propose the epithet "*G. vvedenskyi* Bobr." (nomen novum), after the well-known botanist who studied the group of tuberiferous geraniums and determined the species of Central Asia and the west Caspian area. A definite nomenclatural solution would be reached only after examination of the type in the de Candolle herbarium.

54. *G. kotschyi* Boiss. Diagn. ser. I, XI (1845) 30; Ej. Fl. or. I, 873. —

Perennial; tubers moniliform; radical leaves absent; stems spreadingly branching; cauline leaves multisect into narrow linear lobes; flowers pale lilac or pink. Fl. April–May, Fr. May.

Mountainous steppes and semideserts. — Centr. Asia: Mtn. Turkm.

Gen. distr.: Iran. Described from Elburz. Type in Geneva, cotype in Leningrad.

55. *G. charlesii* (Aitch. et Hemsl.) Vved. ex Nevski in Tr. Bot. Inst. AN SSSR, ser. I, IV (1937) 304, comb. — *G. tuberosum* var. *Charlesii* Aitch. et Hemsl. in Curtis Bot. Mag. CXII (1886) tab. 6910; Ej. in Trans. Linn. Soc., ser. 2, III (1888) 46. — Ic.: l.c.

Resembles the preceding species, in particular *G. transversale* (Kar. et Kir.) Vved., from which it is distinguished by the absence of radical leaves, the cauline leaves deeply dissected into 5–7 cuneate lobes, lobes

parted above for less than half into lanceolate lobules. Also characterized by the very thin pedicels and the much thinner attenuate beak, the larger underground, moniliform tubers, the dark pink flowers, and, in addition, by having a unique habit due to the spreading branches. Fl. May, Fr. June. (Plate III, Figure 8.)

Slopes of the submontane belt, 1,000–3,000 m.—Centr. Asia: Pam.-Al., (south, from Kugitang to Darvaza Range). **Gen. distr.:** Iran (N. Afghanistan). Described from Parapamiz Range. Type in London, cotype in Leningrad.

63 Genus 831. **ERODIUM*** L'Hér**

L'Hér. Geran. (1737) Plates 1–6.

Flowers regular or more or less irregular because of the unequal petals, some species dioecious with partly abortive flowers. Glands 5, alternating petals. Sepals 5. Petals 5. Stamens 10, 5 of which with anthers and 5 sterile. Mericarps indehiscent, beak deciduous or persistent, spirally coiled below. Annual or perennial herbs.

1. Beak of fruit deciduous, pinnate (as in feather grass). Mericarps without pits at apex 2.
- + Beak persistent, pinnate. Mericarps with 2 pits at apex 3.
2. Stems and petioles covered with fine appressed hairs
- 1. *E. oxyrrhynchum* M.B.
- + Stems and petioles covered with long spreading hairs
- 2. *E. litvinovii* Voron.
3. Perennials 4.
- + Annuals 13.
4. Plant canescent with appressed hairs, eglandulose, forming small bundles. Leaves pinnatisect. Beak ca. 15 mm long
- 3. *E. tibetanum* Edgew.
- + Beak 20 mm long or usually longer 5.
5. Monoecious plants 6.
- + Dioecious plants 9.
6. Acaulescent plant, finely appressed-hairy
- 5. *E. tataricum* Willd.
- + Stems developed. Plant with long spreading or recurved hairs, at least at stem below 7.
7. Leaves bipinnatisect 8.
- + Leaves pinnatisect in lower part of blade, pinnatipartite or lobed in upper part. Petals 14–16 mm long 12. *E. ruthenicum* M. B.
8. Sepals 4–5, 6 mm long in fruit. Mericarps 6 mm long
- 6. *E. stevenii* M. B.
- + Sepals 5–6, 9 mm long in fruit. Mericarps 9 mm long
- 4. *E. stephanianum* Willd.
9. Plant canescent with fine appressed hairs 10.
- + Plant with long, usually recurved hairs . . . 11. *E. armenum* Voron.

* Treatment by A.I. Vvedenskii.

** From the Greek *erodios* — heron's bill, for the beak shape of the fruit.

- 64 10. Beak ca. 20 mm long 8. *E. schemachense* Grossh.
 + Beak 30–80 mm long 11.
 11. Leaves pinnatisect up to the middle part of blade, pinnatipartite with
 confluent lobes in the upper part 9. *E. fumarioides* Stev.
 + Leaves bipinnatisect 12.
 12. Leaf lobes not contiguous with stem. Beak 50 mm long
 7. *E. beketovii* Schmalh.
 + Leaf lobes contiguous with stem. Beak ca. 80 mm long
 13. 10. *E. anthemidifolium* M. B.
 13. At least the lower leaves 3–5-lobed 14.
 + All leaves pinnatipartite, pinnatisect or bipinnatisect 16.
 14. Plant covered with erect hairs. Mericarps 6 mm long. Beak
 60–70 mm long 16. *E. hoefftianum* C. A. M.
 + Plant covered with curly hairs. Mericarps 4 mm long. Beak
 20–40 mm long 15.
 15. Leaves pinnatifid. Mericarps with pit encircled by fold. Beak
 20–25 mm long 13. *E. malacoides* Willd.
 + Leaves deeply pinnatipartite or pinnatisect. Mericarps with pit
 without encircling fold. Beak 35–40 mm long
 14. *E. chium* Willd.
 16. Stems densely covered with recurved bristles. Glandular hairs
 usually absent or sometimes on pedicels and calyx
 15. *E. strigosum* Karel.
 + Plant covered with laminated hairs, glandular hairs more or less
 profuse 17.
 17. Petals 4–6 mm long. Leaf segments not contiguous with stem.
 Beak 20–40 mm long 18. *E. cicutarium* (L.) L'Hér.
 + Petals 7–8 mm long. Leaf segments contiguous with stem. Beak
 60–100 mm long 17. *E. ciconium* (L.) Ait.

Section 1. PLUMOSA Boiss. Fl. or. I (1867) 885. — Beak deciduous,
 pinnate (resembling feather grass). Mericarps without pits at apex.

1. *E. oxyrrhynchum* M. B. Fl. taur.-cauc. 2 (1808) 133; Ldb. Fl.
 Ross. I, 417; Boiss. Fl. or. I, 896 (excl. syn. *E. Hohenackeri*);
 Shmal'g., Fl. I, 197; Voron. in Mat. Fl. Kavk. III, 7; Grossg., Fl. Kavk.
 III, 8; Kryl., Fl. Zap. Sib. VIII, 1837. — *E. guttatum* Ldb. Fl. Ross.
 I (1842) 478. — *E. obtusilobum* Karel. ex Ldb. Fl. Ross. I (1842) 477. —
 Exs.: G. R. F. No. 1856 (sub *E. bryoniaefolio*).

Annual; plant with fine appressed hairs, eglandulose; stems prostrate
 65 or ascending, 15–30 cm long; leaves ovate or ovate-triangular, obtuse,
 3-lobed or often 3-partite, with obtusely incised or sometimes pinnati-
 partite lobes of which the median much larger than the lateral. Sepals
 4–5 mm long, in fruit 7 mm, short-awned; petals purple-violet, 6–7 mm
 long; mericarps 6 mm long, with transverse wrinkle below apex; beak
 70–110 mm long. April–May.

Dry stony and sandy places in deserts and at foothills. — Caucasus:
 E. and S. Transc., Tal.; Centr. Asia: Ar.-Casp., Balkh., Kyz. K., Kara K.,
 Amu D., T. Sh., Pam.-Al., Mtn. Turkm. Gen. distr.: Arm.-Kurd.
 Described from the Kura River. Type in Leningrad.

2. *E. litvinovii* Voron. in Mat. Fl. Kavk. III, 7 (1910) 92. —
E. bryoniaefolium et *E. Hohenackeri* auct. fl. As. Med.

Annual; plant covered with spreading hairs, eglandulose; stems prostrate or ascending, 10–30 cm long; leaves cordate, entire or usually 3–(5) lobed, lobes large-crenate, the median larger. Sepals 5 mm long, 9 mm in fruit, short-awned; petals purple-violet, 7–8 mm long; mericarps 8–9 mm long, with transverse wrinkle below apex; beak 120 mm long. April–June.

Fine earth and stony slopes, often gypsiferous, in foothills. —
Centr. Asia: Kyz. K., Pam.-Al., Mtn. Turkm. Described from Ashkhabad district (Karanki). Type in Leningrad.

Section 2. BARBATA Boiss. Fl. or. I (1867) 884. — Beak persistent, not pinnate. Mericarps with 2 pits at apex.

3. *E. tibetanum* Edgew. in Hook. Fl. Brit. Ind. I (1875) 434; Maxim. in Bull. Acad. Pétersb. 26 (1880) 467; O. Fedtsch. in Mat. pozn. faun. fl. Bot. 5 (1905) 19. — Ic.: Pflanzenr. IV, 129 (1912) 252, f. 32, F.

Perennial; plant canescent with appressed hairs, eglandulose, forming small bundles; stems prostrate, not exceeding leaves; leaves many, long-petioled, ovate, cordate at base, pinnatipartite into oblong, laciniate, sometimes nearly parted lobes. Sepals 3–4, 6 mm long in fruit, awnless; petals nearly twice as long as sepals, lilac (?); mericarps 6 mm long, with pit without encircling fold; beak ca. 15 mm long. July–August.

Stony places. — Centr. Asia: Pam.-Al. (Pamir). Gen. distr.: Mong., Tib., Ind.-Him. Described from N. India. Type in London.

4. *E. stephanianum* Willd. Sp. pl. III (1800) 625; Ldb. Fl. Ross. I, 475; Kryl., Fl. Zap. Sib. VIII, 1835. — Ic.: Ldb. Ic. pl. fl. Ross. 2 (1830) tab. 184.

66 Perennial; plant appressed-hairy, sometimes mixed below with long spreading hairs, eglandulose; stems ascending, 15–60 cm high; leaves ovate, bipinnatisect into lanceolate acute entire or laciniate lobes, with long lobules decurrent on stem. Sepals 5–6 mm long, in fruit 9 mm, with very long (3 mm) awn; petals lilac, 6–8 mm long; mericarps 9 mm long, pit without encircling fold; beak 30–40 mm long. July–August.

Dry slopes, sandy riverbanks, also as a weed. — W. Siberia: Alt.; E. Siberia: Ang.-Say., Dau.; Far East: Ze.-Bu., Uss.; Centr. Asia: Balkh., T. Sh. (Issyk-Kul), Pam.-Al. (Vakhan). Gen. distr.: Mong., Jap.-Ch., Dzu.-Kash., Tib. Described from Dauria (Chikoi River). Type in Berlin.

5. *E. tataricum* Willd. Spec. pl. III (1800) 625; Ldb. Fl. Ross. I, 474; Shipch. in Izv. Glav. Bot. Sada, 18, 2 (1918) 14. — *Geranium tataricum* Poir. Encycl. Suppl. 2 (1811) 741.

Perennial; monoecious green acaulescent plant, with appressed hairs mixed with very tiny glandular ones usually on pedicels and sepals; root-neck covered with fibrous relics of dead leaves; all leaves radical,

oblong-lanceolate, distinctly bipinnatisect into linear, entire or 1-toothed, obtuse, not contiguous lobes. Peduncles basal, 5–10 cm high, 2–6-flowered; sepals 6–7 mm long, in fruit 9 mm, short-awned; petals violet-purple, unequal, the larger two obovate, 14 mm long, the others 8 mm long; mericarps 7 mm long, with pit without encircling fold; beak 30–40 mm long. July–August.

Stony and pebbly places. — E. Siberia: Ang.-Say. (Minusinsk district). Endemic. Described from "Tatary and Siberia." Type in Berlin.

6. *E. stevenii* M. B. Fl. taur.-cauc. II (1808) 132; Ldb. Fl. Ross. I, 475; Boiss. Fl. or. I, 888; Voron. in Mat. Fl. Kavk. III, 7 (1910) 109 (excl. syn. *E. Beketovii*). — *E. fumaroides* Schmalh., Fl. Sr. i Yuzhn. Ross. I (1895) 198 (p. p. quoad spec. Akinf.).

Perennial; monoecious plant, canescent with fine appressed hairs, hirsute below with usually recurved bristles, eglandulose; stems ascending, 10–20 cm high; leaves oblong, bipinnatisect into oblanceolate acute 1–2 lacinate lobules, segments contiguous on stem as linear lobes. Sepals 4–5 mm long, in fruit 6 mm, with 2 mm long awn; petals pale lilac, 8–9 mm long; mericarps 6 mm long, with pit without encircling fold; beak 24 mm long. June.

Sands and limestones (?). — Caucasus: Cisc. Endemic. Described from Stavropol' district. Type in Leningrad.

67 7. *E. beketovii* Schmalh., Fl. Sr. i Yuzhn. Ross. I (1895) 198. —

Perennial; dioecious plant, canescent with fine hairs appressed above, eglandulose; stems erect, branching, 15–20 cm high; leaves oblong, distinctly bipinnatisect into long, linear, entire, obtuse, not decurrent lobes. Sepals 6–7 mm long (in fruit?), short-awned; petals lilac, 8 mm long; beak up to 50 mm long. July.

Outcrops. — European part: L. Don (along Kalmius and Kalchik rivers). Endemic. Described from the vicinity of Karakub. Type in Leningrad.

8. *E. schemachense* Grossh., Fl. Kavk. III (1932) 10.

Perennial; plant dioecious (?), densely covered with appressed gray hairs, eglandulose (?); stems 5–20 cm high, densely leafy at base; leaves oblong, bipinnatisect into very small obtuse lobules. Sepals . . . ; petals pink, ca. 10 mm long; beak ca. 20 mm long.

Rocks in the alpine belt. — Caucasus: E. Transc. ("Bak. (Shemakh. Kub.)"). Endemic. Described from the indicated district, without more specific data. Type in Baku.

Note. This species is known to us only from the original description. This species as well as *E. fumaroides*, *E. armenum*, *E. anthesifolium*, *E. absinthoides* and a group of other closely related Asia Minor species should be critically studied with good material; the current data are extremely inadequate, mainly because the collectors ignored the dioecism of these plants.

9. *E. fumaroides* Stev. in Mém. Soc. Nat. Mosc. 4 (1813) 89; M. B. Fl. taur.-cauc. III, 453; Ldb. Fl. Ross. I, 475; Shmal'g., Fl. I, 198 (p. p. quoad spec. dagest.); Voron. in Mat. Fl. Kavk. III, 7, 105; Grossg., Fl. Kavk. III, 10. — *E. absinthoides* Boiss. Fl. or. I (1867) 886

(p. p. quoad Spec. Stev.).— *Myrrhina fumarioides* Rupr. in Mém. Acad. Pétersb. 7 ser. 15, 2 (1869) 277.— *M. gunibensis* Rupr. l. c. 278.— *E. absinthoides* var. *fumarioides* Boiss. Fl. or. Suppl. (1888) 144.— Exs.: Herb. Fl. Cauc. No. 379.

Perennial; dioecious plant, covered with fine gray recurved-appressed hairs, eglandulose; stems ascending, 10–25 cm high; leaves oblong, pinnatisect below up to the middle, pinnatipartite in the upper part, deeply pinnatisect or pinnatipartite obtuse lobes and lobules, segments decurrent on stem. Sepals 5–6 mm long, 13 mm in fruit; petals emarginate, bluish-violet, 11–13 mm long; mericarps 9 mm long, with pit without encircling fold; beak 30–40 mm long. July–August.

58 Stony and pebbly slopes, 1,300–2,200 m.—Caucasus: Dag. Endemic. Described from Shakh-Dag Mountain. Type in Helsinki.

10. *E. authemidifolium* M. B. Fl. taur.-cauc. II (1808) 131; Ldb. Fl. Ross. I, 475; Boiss. Fl. or. I, 888; Voron. in Mat. Fl. Kavk. III, 7 (1910) 107; Grossg., Fl. Kavk. III (1932) 10.— *Myrrhina anthemoides* M. B. ex Rupr. in Mém. Acad. Pétersb. 7 sér. 15, 2 (1869) 277.

Perennial; dioecious plant, canescent with fine curly hairs, glandular in the upper part; stems prostrate, branching; leaves oblong, bipinnatisect into lanceolate, acute or obtuse, entire or sometimes 1–2 lobes, with lobules decurrent on stem. Sepals ca. 5 mm long, 10 mm in fruit, with very short, sometimes inconspicuous awn; petals bluish, 9–11 mm long; mericarps 10 mm long, with pit without encircling fold; beak ca. 80 mm long. July.

Stony places.—Caucasus: E. Transc. (Gori). Gen. distr.: Arm.-Kurd. Described from "Western Iberia." Type in Leningrad.

11. *E. armenum* Voron. in Tr. B. S. 28 (1909) 432; Ej. in Mat. Fl. Kavk. III, 7 (1910) 110.— *E. absinthoides* var. *armena* Trautv. in Tr. B. S. 2 (1873) 517.— Exs.: Herb. Fl. Cauc. No. 378; Fl. cauc. exs. No. 265.

Perennial; dioecious plant, covered with fine glandular hairs and long bristly usually recurved ones; stems ascending, 10–30 cm high; leaves oblong, 2–3-sect into linear or linear-lanceolate acute lobules, with segments decurrent on stem. Sepals 5–7 mm long, 10 mm in fruit, with short awn, sometimes nearly absent; petals violet, 8–12 mm long; mericarps 8 mm long, pit without encircling fold; beak 35–40 mm long. July–August.

Subalpine and alpine meadows.—Caucasus: S. Transc. Gen. distr.: Arm.-Kurd. Described from Darachichak Mountain. Type in Leningrad.

12. *E. ruthenicum* M. B. Pl. rar. cent. I (1810) tab. 48.— *E. serotinum* Stev. in Mém. Acad. Pétersb. 3 (1811) 297, tab. 15, f. 2; Ldb. Fl. Ross. I, 475; Boiss. Fl. or. I, 889 (p. p. excl. spec. Aucher.); Shmal'g., Fl. I, 199; Voron. in Mat. Fl. Kavk. III, 7, 96; Grossg., Fl. Kavk. III, 10.— *E. multicaule* Link, Enum. 2 (1822) 184.— Ic.: M. B. l. c.; Stev. l. c.

Perennial; plant densely canescent-hirsute with spreading or recurved hairs, eglandulose; stems prostrate or ascending, 20–70 cm high; leaves oblong-ovate, more or less cordate at base, pinnatisect below, pinnatipartite or lobate in the upper part, with decurrent deeply incised lobes and

69 lobules, large-acute-serrate. Inflorescence umbelliform, usually many-flowered; sepals 5–6 mm long, 9 mm in fruit, with 2–3 mm long awn; petals oblong-obovate, 14–16 mm long; mericarps 6 mm long, with pit without encircling fold; beak 45–70 mm long. May–June.

Sandy and stony places. — European part: Bl., Bes.; Caucasus (??).

Gen. distr.: Centr. Eur. (Rumania, Transylvania). Described from the south of the European part of the USSR. Type in Leningrad.

Note. The occurrence of this western species in the Caucasus (even in Ciscaucasia) is highly doubtful. In the case of "Kavkaz. Adam, herb Mertens" there is no question but that the labels were mixed up. It has already been proved that the report of this species from Transcaucasia was based on a misunderstanding.

13. *E. malacoides* (L.) Willd. Phyt. (1794) 10; Boiss. Fl. or. I (1867) 893; Voron. in Mat. Fl. Kavk. III, 7 (1910) 93; Grossg., Fl. Kavk. 3 (1932) 9. — *Geranium malacoides* L. Sp. pl. (1753) 680. — *E. Hohenackeri* Ldb. Fl. Ross. I (1842) 478. — Ic.: Rchb. Ic. Fl. Germ. 5 (1841) fig. 4868 (sub *Herodio malacoides*). — Exs.: G. R. F. No. 1711.

Annual; plant covered with soft curly hairs, glandular above, leaves sometimes hairy with mixture of different kinds; stems usually ascending, (5)20–40(80) cm high; leaves ovate, cordate at base, rounded above, usually pinnately 3–5-lobed, strongly crenate-dentate, rarely entire, the lower leaves long-petioled. Pedicels more than twice as long as sepals; bracts many; sepals 4–5 mm long, 6 mm in fruit, short-awned, densely glandular; petals pink-lilac, 6–7 mm long; mericarps ca. 4 mm long, with pit surrounded by fold, often with another fold below pit; beak 20–25 mm long. May–June.

Dry slopes, fields, as a weed. — European part: Crim. (Simeiz); Caucasus: S. and E. Transc.; Centr. Asia; Mtn. Turkm. (Kara-Kala). Gen. distr.: Med., Iran. Introduced into the holarctic region, S. Africa, N. and S. Am. Described from Italy. Type in London.

14. *E. chium* (Burm. f.) Willd. Phyt. (1794) 10; Boiss. Fl. or. I, 894. — *Geranium chium* Burm. f. Geran. (1759) 32. — *Erodium malacoides* Voron. in Mat. Fl. Kavk. III, 7 (1910) 93 (quoad spec. Owerin.).

Annual; plant sparingly curly-hairy, eglandulose (sometimes only pedicels and sepals sparsely covered with glandular hairs); stems prostrate, 50–70 cm long; leaves ovate, more or less cordate or truncate at base, rounded at apex, pinnatipartite or often deeply pinnately lobate with decurrent incised lobes largely crenate-dentate, lower leaves petioled. Pedicels of lower peduncles 4–5 times longer than sepals, of the upper 2–3 times; bracts numerous; sepals 4–5 mm long, 6 mm long in fruit, with ca. $\frac{1}{2}$ mm long awn; petals pink, ca. 6 mm long; mericarps ca. 70 4 mm long, pit without encircling fold; beak 35–40 mm long. Fl. and Fr. probably May–June.

Habitat unknown. Obviously an introduced plant. — Caucasus: (where?). Gen. distr.: Med., introduced into the holarctic region. Described from Chios Island. Type in Paris.

Note. This species is known from Overin's collections, but unfortunately precise data are unavailable. There is only the note "Caucasus." Voronov (l.c.) included these specimens in *E. malacoides*, adding that they are slightly reminiscent of *E. chium*. We compared Overin's plant with many specimens of this species from the Mediterranean area and with descriptions in different Floras and have seen no difference between them except, possibly, for the sparse glandular hairs on the pedicels and sepals; however, we have also seen such plants from the Mediterranean area.

15. *E. strigosum* Karel. in Ldb. Ross. I (1842) 475; Voron. in Mat. Fl. Kavk. III, 7, 94; Grossg., Fl. Kavk. III, 9. — *E. laciniatum* auct.

Annual; plant densely hirsute with antrorse or retrorse hairs, sometimes glabrous in the upper part, eglandulose or sometimes glandular above; stems prostrate to ascending, 10–30 cm long; leaves oblong-ovate, pinnatipartite or pinnatisect, more or less cordate at base, with lobate or large-dentate lobes; stipules 2–3, large. Sepals 4–5 mm long, 7 mm in fruit, short-awned; petals pink-lilac, 7–9 mm long; mericarps ca. 5 mm long, with pit without encircling fold; beak 50–60 mm long. April–May.

Sands, as a weed. — Caucasus: E. Transc., Tal. Gen. distr.: E. Med., Described from Talysh. Type in Leningrad.

Note. This species is referred to the Mediterranean complex of *E. laciniatum* auct. (incl. *E. pulverulentum* auct.) and requires further study. Apparently it does not extend far in the west; the plants collected in Asia Minor (in arenosis Pamphylliae, Heldreich) and in the sands of Crete (Reverchon) are by no means different from the typical *E. strigosum* and thus it cannot be regarded as a species of the Caspian area, as Voronov assumed (l.c.). It is noteworthy that in the plants from Talysh and Sara Island, i.e., the types, the lower part of the stem is covered with downturned hairs, in all the other Caucasian plants the hairs are upturned or at least horizontally spreading.

16. *E. hoefftianum* C. A. M. in Mém. Acad. Pétersb. 6 ser. 7 (1855) 3; Shmal'g., Fl. I, 199; Voron. in Mat. Fl. Kavk. III, 7 (1910) 97. — *E. Semenovii* Rgl. in Bull. Soc. Nat. Mosc. 39, 1 (1866) 553. — *E. Neilreichii* Janka in Oest. Bot. Zeit. 17 (1867) 101. — *E. serotinum* var. *plurijugum* Boiss. Fl. or. I (1867) 179. — Ic.: Pflanzenr. IV, 29 (1912) 256, fig. 33. — Exs.: Herb. Fl. As. Med. No. 70.

Annual; plant glandular-pubescent, soft-hairy below; stems ascending or prostrate, 10–30 cm long; leaves purple along veins, oblong, pinnatipartite or pinnatisect (deeply lobate at apex), with segments acutely large-serrate and decurrent on stem. Sepals 4–5 mm long, 7 mm in fruit, long-awned; petals pink-lilac, 7–9 mm long; mericarps 6 mm long, pit without encircling fold; beak 60–70 mm long. April–May.

Semideserts, deserts, foothills, mainly on sandy soil. — European part: Bl., L. V., Crim. (?); Caucasus: Cisc., E. and S. Transc.; Centr. Asia: Balkh., Syr D., Kyz. K. (SE), T. Sh. (Chu-Ili Mountains), Mtn. Turkm.

Gen. distr.: Centr. Eur. Described from the Caucasus (Kizlyar). Type in Leningrad.

17. *E. ciconium* (L.) Ait. Hort. Kew. 2 (1789) 415; M. B. Fl. taur.-cauc. II, 135; Ldb. Fl. Ross. I, 476; Boiss. Fl. or. I, 891; Shmal'g., Fl. I, 198; Voron. in Mat. Fl. Kavk. III, 7, 100; Grossg., Fl. Kavk. III, 9. — *Geranium ciconium* L. Cent. I (1755) 21. — Ic.: Rchb. Ic. Fl. Germ. 5 (1841) f. 4866.

Annual; plant covered with lamelliform and simple hairs, more or less glandular; stems ascending or prostrate, 15–30 cm long; leaves oblong-ovate, bipinnatisect, with strongly decurrent segments, lobes usually incised-lobate. Sepals 6–7 mm long, 12 mm in fruit, long-awned; petals lilac, 7–8 mm long; mericarps 10–11 mm long, pit without encircling fold; beak 60–100 mm long. April–June.

Semideserts, deserts, slopes in foothills and as a weed. — European part: M. Dnp. (Klintsy), Bl., Bes., Crim.; Caucasus: everywhere; Centr. Asia: Syr D., Pam.-Al., Mtn. Turkm. Gen. distr.: Centr. Eur., Med., Bal.-As. Min., N. Am. (introduced). Described from S. Europe. Type in London.

18. *E. cicutarium* (L.) L'Hér. in Ait. Hort. Kew. 2 (1789) 414; Ldb. Fl. Ross. 476; Boiss. Fl. or. I, 890; Shmal'g., Fl. I, 198; Voron. in Mat. Fl. Kavk. III, 7; Grossg., Fl. Kavk. III, 8; Kryl., Fl. Zap. Sib. VIII, 1835. — *Geranium cicutarium* L. Sp. pl. (1753) 680. —? *E. pulchellum* Karel. ex Ldb. Fl. Ross. I (1842) 476. — *E. Jacquini* auct. fl. As. Med.

Annual; plant covered with lamelliform hairs, more or less glandular; stems prostrate or ascending, 10–50 cm high; leaves oblong, pinnatisect, with pinnatifid or pinnatisect segments decurrent on stem. Sepals 4–5 mm long, 7 mm in fruit, short-awned; petals pink-purple, 4–6 mm long; mericarps ca. 5 mm long, not tuberculate, pit surrounded by fold; beak 20–40 mm long. April–July.

- 72 Dry slopes, steppes, semideserts, deserts, foothills and as a weed growing far to the north and east. — European part: everywhere; Caucasus: everywhere; W. Siberia: everywhere; E. Siberia: Ang.-Say.; Far East: Uda, Kamch., Uss.; Centr. Asia: everywhere. Gen. distr.: Scand., Centr. Eur., Atl. Eur., Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Jap.-Ch., Am. (introduced), Australia (introduced). Described from Europe. Type in London.

Genus 832. *PELARGONIUM* *L. Hér.**

L'Hér. Geran. (1787–1788) tab. 7; Knuth in Pflzr. 53 Heft, 316

Flowers irregular; sepals 5, imbricate, united, joined to pedicel forming a long spur; petals 5, the upper two larger; glands absent; stamens 10, 7 of which antheriferous; ovary 5-lobed, 5-locular, elongate-rostriform above, with style filiform above and 5 stigmas; carpels 1-seeded, with elastic

* Treatment by E.G. Bobrov.

** From the Greek *pelargos* — storkbill, due to the resemblance of the fruit to the bill of a stork.

appendage coiled above. Herbs or semishrubs, with radical or opposite leaves, more or less densely pubescent; flowers in umbellate inflorescences on axillary peduncles.

Pelargonium comprises about 250 species distributed mostly in S. Africa. Three occur in Australia and one in Near Asia which reaches the borders of the USSR. Cultivation of the plants in Europe started at the beginning of the 18th century, and they became very popular indoor plants. In the south, particularly in the Mediterranean countries, they are cultivated outdoors as hybrid forms of different grades of complexity and it has been extremely difficult to establish their origin. Most of the species are included in the section *Pelargium* which also includes the widely known rose geraniums.

Popular indoor plants are *P. zonale* (L.) Aiton, with its orbicular-reniform leaves and *P. radula* (Cav.) L'Hér., with its deeply incised leaves. Commonly hybridizing with other species.

Rose geranium, known as *P. roseum* Willd., is a hybrid complex, the oil of its plants is used in the manufacture of perfumes and soap. It is a substitute for the expensive attar of roses. The oil is obtained by distillation and combines with other essential oils that form the basis of many perfumes.

- 73 The first attempts at cultivation of rose geranium in the USSR started in the mid 20s and became so successful that ten years later (1934–1935)[?] it reached first place in the world production of geranium oil. About 80% of the area under cultivation lies in Abkhazia and about 10% in the Adzhar ASSR (see Vorontsov V. Prilozh. 77 k "Tr. po prikl. botan.," 1936). In recent years it has been demonstrated that there are possibilities of growing this valuable plant in the southern Soviet Republics of Central Asia.

1. *P. endlicherianum* Fenzl, Pugil. pl. nov. (1842) 6; Boiss. Fl. or. I, 898; Grossg., Fl. Kavk. III, 11. — Ic.: Bot. Mag. LXXXII, tab. 4946; Vestn. Ross. Obshch. Sadov. 1860, tab. 37. — Exs.: Fl. cauc. exs. No. 266.

Perennial; herbaceous plant, 30–50 cm high, with thick oblique rhizome; stems nearly simple or hardly branching, fleshy, rounded, densely canescent-appressed-hairy, covered below with stipules and petioles; radical leaves numerous, petioles densely canescent-pubescent, longer than half of stem, blades 3–6 cm wide, orbicular, cordate at base, somewhat incised at margin into 5–7 rounded, obscurely crenate-dentate lobes; cauline leaves sometimes present, small, with blades deeply cut into 3–5 lanceolate lobes of which the upper one very large. Peduncles 6–15 cm long, thick, bearing umbellate, 5–15-flowered inflorescence; bracts mostly involucrel, narrow, pubescent, sometimes slightly developed and leaflike; pedicels together with calyx-spur up to 4 cm long, without spur up to 5–7 mm long, thick; sepals 7–13 mm long, lanceolate, acuminate, pubescent, sometimes scarious at margin; two upper petals 2 to 3 times as long as sepals, broadly spatulate-ovate, clawed, unevenly and undulate-notched above, pink with purple nerves, 3 lower petals much shorter and smaller than sepals, pale; fruit ca. 4 cm long, with densely pubescent carpels and beak. Fl. May–June, Fr. June–July.

Rock streams on slopes and among rubble debris in valleys. — Caucasus: W. Trans. (known only from the former Artvin and Ol'tin districts). Gen. distr.: Arm.-Kurd. and in the south to N. Syria. Described from the western part of Taurus Mountains. Type in Geneva.

Tribe 2. **BIEBERSTEINIEAE** (Endl.) Boiss. Fl. or. I (1867) 899; Endl. Gen. (1840) 1165, pro fam. — Carpels without appendages, coriaceous, indehiscent, slightly detached from axis; all 10 stamens antheriferous.

74 Genus 833. **BIEBERSTEINIA** * Steph.**

Steph. in Mém. Soc. Nat. Mosc. I (1806) 126.

Flowers regular. Sepals 5. Petals 5. Glands 5, alternating petals. Stamens 10, all fertile, forming a ring at base. Ovary not beaked. Perennial herbs.

1. Semishrubs, with pinnatisect leaves. Petals entire, one-third to one-fourth as long as sepals 1. *B. odora* Steph.
- + Herbaceous plants, with fleshy lobate root; petals lacinate at apex, hardly longer than sepals at the beginning of anthesis, later much shorter 2. *B. multifida* DC.

Subgenus 1. *Eubiebersteinia* Vved. subgen. n. — Subdiv. *Pim-pinellaefolia* Jaub. et Sp. III. pl. or. 2 (1844–1846) 109. — Sepals not accrescent post anthesis. Semishrubs with stems woody below and covered with petioles of dead leaves.

1. *B. odora* Steph. in Mém. Soc. Nat. Mosc. I (1806) tab. 9; Ldb. Fl. Ross. I, 487; Kryl., Fl. Zap. Sib. VIII, 1838. — Ic.: Ldb. Ic. pl. Fl. Ross. 5 (1834) tab. 447.

Perennial; semishrub, covered with many stalked glands having a strong odor when fresh; stems woody below, somewhat branching, densely covered with lignified relics of dead petioles, bearing 1–2 or tufts of leaves at summit or leafless; annottinous stems simple, pubescent, together with raceme 8–25 cm high; radical leaves linear-lanceolate, pinnatisect, pubescent, shorter than stem, segments many, dense, broadly ovate, pinnatipartite into obtuse lobules; petioles much shorter than blade; cauline leaves reduced; stipules pubescent, usually slightly glandular, entire or rarely a little incised at apex. Raceme few-flowered, dense, flowers drooping at first, the lower remote; bracts obovate, obtuse, hardly pubescent, shorter than pedicels, entire, the lower without flowers, sometimes slightly lobate; pedicels very densely hairy, longer than calyx, the lower with 2 lanceolate bracteoles; sepals elliptic, obtuse, densely pubescent, with few stalked glands, 7–9 mm long; petals yellow, broadly obovate, obtuse, sometimes crenate at apex, $1\frac{1}{4}$ or $1\frac{1}{2}$ times as long as sepals; filaments long-hairy; ovary pubescent. July–August.

- 75 Rocks and stones on slopes in the alpine zone. — W. Siberia: Alt.; Centr. Asia: Dzu.-Tarb. Gen. distr.: Dzu.-Kash. Described from the Chuya River (Altai). Type in Leningrad.

* Treatment by A. I. Vvedenskii.

** After Bieberstein, author of Krymsko-kavkazskaya flora (Flora of the Crimea and the Caucasus).

Note. This species is closely related to the Tibetan-Himalayan *B. emodi* J. et Sp. which is often regarded as a synonym of *B. odora* Steph. Apparently, the strongly lacinate and more glandular stipules are the distinguishing character.

Subgenus 2. *Achillaeophyllum* Vved. subgen. n. — Sepals accrescent post anthesis. Perennial herbs, often with thickened root and tripinnatisect leaves.

2. *B. multifida* DC. Prodr. I (1824) 708; Ldb. Fl. Ross. I, 487; Trautv. in Bull. Soc. Nat. Mosc. 33, 1, 468; Boiss. Fl. or. I, 899; Grossg., Fl. Kavk. 3, 11. — *B. Aucheri* Jaub. et Sp. III. pl. or. 2 (1844–1846) 110, tab. 190. — *B. brachypetala* J. et Sp. l. c. 113, tab. 192 A. — *B. ambigua* J. et Sp. l. c. 110. — *B. leiosepala* J. et Sp. l. c. 114, tab. 193; Boiss. l. c. 900. — Ic.: J. et Sp. l. c. tab. 191, 192 A et B, 193. — Exs.: Herb. Fl. As. Med. No. 430.

Perennial; plant villous-hairy, covered with stalked glands, herbaceous; root thickened, often lobate, covered at neck with large brown scarious scales; stems sturdy, often purple below, spreading-branching in upper part, together with inflorescence 15–40 cm high; leaves lanceolate, tripinnatisect into linear acute lobes, subsessile, with robust rachis and scarious brown stipules; radical leaves absent. Flowers in racemiform loose inflorescences at apices of stem and branches; bracts obovate, flabellate-pinnatifid, acute, the lower shorter, the upper longer than pedicels; bracteoles close to flower, lanceolate, acuminate; sepals ovate, acute to obtuse, markedly elongating in fruit; petals yellow, nearly orange, 5–8 mm long, slightly shorter or slightly longer than sepals at onset of anthesis, glabrous or hairy-ciliate, obovate or oblanceolate or elliptic, rhombic or broadly cuneate, dissected at apex; filaments glabrous or rarely ciliate; fruit glabrous, rugose. April–June.

Clayey and hilly slopes and cliffs from the desert to the middle mountain zone; also in plains but apparently always on saliferous substrata. — Caucasus: S. Transc.; Centr. Asia: Ar.-Casp., Balkh. (Kosh-Cheku), Syr D., T. Sh., Pam.-Al., Mtn. Turkm. Gen. distr.: Iran. Described from Iran. Type in Geneva.

Note. The southern Pamir-Alai plants usually have hairy-ciliate petals. Ciliatio. of the filaments in the Central Asian plants is observed very rarely. Their filaments are generally glabrous which discriminated them from the Iranian. Even when they have hairy sepals [?], the Iranian plants do not always have hairy filaments as depicted in the plate drawn up 76 by Joubert and Spach. We have never seen the kind of entire petals drawn by the authors for some of the species.

Family LXXX. **OXALIDACEAE** * LINDL.

Flowers regular, one to many on scapes; calyx persistent, with 5 sepals; petals 5, with erect claws and rolled limb spreading in aestivation;

* Treatment by S.G. Gorshkova.

stamens 10, filaments subulate, erect, usually connate at base, the outer five opposite sepals short, often dentate, the inner five opposite petals long; anthers 2-locular; pistil 1, with superior 5-locular, 5-angled ovary and 5 filiform styles with penicillate or capitate or nearly 2-partite stigmas; fruit a capsule (rarely a berry). Herbaceous plants (or semi-shrubs). Leaves alternate, rarely opposite or nearly whorled, simple or compound.

There are 8 genera and ca. 900 species in this family. They are represented in the USSR by *Oxalis*.

Genus 834. **OXALIS** * L.

L. Sp. pl. (1753) 433.

Flowers regular; calyx persistent, with 5 free or basally connate sepals; petals 5, yellow, white, blue or pink, sometimes with pinkish or violet nerves and rarely with yellow spot at base or petals violet; stamens 10, connate at base of filaments, the outer five short and the inner five long; ovary ovoid or oblong, 5-angled, 5-locular, with 5 glabrous or pubescent styles and capitate stigmas; capsule ovoid or oblong-ovate or oblong or cylindrical, nearly pentagonal, 5-cells, 5-valves, dehiscing by 5 longitudinal slits at middle of valves; seeds small, ovate, oval or orbicular, more or less flat, longitudinally or transversely ribbed, with fleshy elastic testa and ejecting seeds from capsule. Herbaceous plants, with acaulescent or developed stems.

Most of the 800 species of *Oxalis* are distributed in S. Africa, C. and S. America, 6 of them grow in the USSR, 2 of which were introduced from N. America (*O. stricta* L. and *O. violacea* L.) and 1 from S. Africa (*O. pes-caprae* L.).

- | | | |
|-------|--|----------------------------|
| 77 1. | Floral scapes many-flowered; petals yellow or violet; seeds transversely ribbed | 2. |
| + | Floral scapes 1-flowered; petals white, rarely lilac-pink or pale purple; seeds longitudinally ribbed | 5. |
| 2. | Plants with developed epigeal stems (5) 7–50 cm high, decumbent or somewhat ascending, rarely erect. Petals yellow | 3. |
| + | Plants without epigeal stems; petals with yellow claws and violet-purple, usually striped limbs | 5. <i>O. violacea</i> L. |
| 3. | Plants more or less pubescent, without tubercles; sepals without any spots; filaments edentate, more or less sparingly pubescent, the inner one-third as long as the outer; seeds 1–2 mm long, 0.7–1 mm wide | 4. |
| + | Plants glabrous, with small tubercles; sepals with 2 orange spots above; filaments glabrous, the inner dentate and twice as long as the outer; seeds 0.7 mm long and wide | 6. <i>O. pes-caprae</i> L. |

* From the Greek *oxys* — sour, and *hale* — salt; Nicander's name for some sour plant.

4. Annuals and biennials; stems usually decumbent, branching, with prostrate shoots; stipules oblong, adnate to petioles; capsule upright, with bent pedicels; seeds 1.7–2 mm long, 1 mm wide 1. *O. corniculata* L.
- + Perennials; stems erect, branching; stipules absent; capsule on obliquely straight pedicels; seeds 1–1.3 mm long, 0.7 mm wide 2. *O. stricta* L.
5. Leaflets obcordate; bracts disposed above the middle of floral scape; calyx nearly one-third as long as petals, more or less pubescent; petals white, sometimes with pink or violet nerves or rarely pale purple or lilac-rose (var. *purpurascens* Mart.); capsule ovoid, 1 cm long, acute; seeds ovate 3. *O. acetosella* L.
- + Leaflets obdeltoide; bracts nearly at base of calyx; calyx half as long as petals, more or less glabrous; petals white; capsule cylindrical, 2–3 cm long, long-acuminate; seeds oval 4. *O. obtruncata* Maxim.

Section 1. CORNICULATAE (Reiche) R. Knuth in Engl. Bot. Jahrb. L. Supplem. (1914) 220. — Div. Trifoliatae sec. Corniculate Reiche in Engl. Bot. Jahrb. XVIII (1894) 300. — Plants with developed rootstock (or rhizome) and with ascending, rarely erect, branching stem. Flowers yellow. Floral scapes 2- to many-flowered.

1. *O. corniculata* L. Sp. pl. I (1753) 435; DC. Prodr. I, 691; Ldb. Fl. Ross. I, 483; Boiss. Fl. or. I, 866; Shmal'g., Fl. I, 200; Kom., Fl. Man'chzh. II, 662; Grossg., Fl. Kavk. III, 12; Sorn. r. SSSR, III, 246. — *O. villosa* M. B. Fl. taur.-cauc. I (1808) 355. — *O. corniculata* β. villosa Hohen. Enum. pl. Talysch. (1837) 159. — Ic.: Jacquin, 78 *Oxalis*, tab. 5; Sibthorp et Sm. Fl. Graeca, V, tab. 451; Rchb. Ic. Fl. Germ. V, tab. 199, f. 1896; Sugawara, III. Fl. of Saghal. III, tab. 573. — Exs.: Fl. Ital. exs. ser. II, No. 1323; Herb. Fl. Cauc. No. 518.

Annual or biennial; appressed-hairy plants, primary root; stems developed, 7–50 cm high, thin, round, sometimes with purple hairs, usually decumbent, spreading-branching, with numerous often prostrate shoots, often rooting at base; stipules small, oblong, 2 mm long, 1 mm wide, adnate to petioles; leaves alternate, ternate, with petioles long, erect, round, pubescent, 1.7–6(9) cm long, jointed at base; leaflets subsessile, obcordate, (0.5)0.8–1.5 cm long, 0.7–1.7 cm wide, deeply emarginate, sometimes covered at lower side with straight, white, appressed hairs, ciliate at margin, longitudinally plicate and pending. Floral scapes erect, shortly jointed at base, round, pubescent, 2.5–5(6) cm long, as long as or longer than leaves, usually 2-flowered; bracteoles 2–3 at base of pedicels, lanceolate or subulate-lanceolate, 3.5 mm long, 0.2–0.3 mm wide, acute pubescent; pedicels 1–1.5 mm long; calyx 4 mm long, half as long as corolla; sepals lanceolate, erect, obtuse, rarely pubescent, ciliate, 3–4 mm long, 1 mm wide, green; corolla subcampanulate; petals yellow, (5)8 mm long, 2 mm wide, with claw erect and limb spreading, obovate, obtuse; filaments connate at base, edentulate, the inner sparingly pubescent above, nearly $1\frac{1}{3}$ times as long as the glabrous outer filaments; anthers oblong, yellow, overlapping;

ovary oblong, 1.8–2 mm long, 0.7 mm wide, sparingly pubescent, with 5 styles covered with simple hairs and as long as the inner filaments; capsules cylindrical, pentagonal, acute, (0.9)1.5–2 cm long, 2–2.5(3) cm wide, pubescent; seeds ovate, flattened, 1.7–2 mm long, 1 mm wide, acute, brown, transversely ribbed. May–July.

Weedy places, roads, ditches, fields, gardens, tea plantations, riverbanks, slopes of oak forests, dry mountain slopes with shrubby formations. — European part: Bl., Crim.; Caucasus: W. Transc., Dag., E. Transc. (Nukha), S. Transc., Tal.; Far East: Uss. (Vladivostok), Sakh. (S. Sakh.); Centr. Asia: Kyz. K., Syr D. (Tashkent), Pam.-Al. Gen. distr.: Centr. Eur., Med. (W.), Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Jap.-Ch. Described from Sicily. Type in London.

Economic importance. A nectariferous plant whose leaves are eaten in the Caucasus in place of sorrel. It is also used in popular medicine.

2. *O. stricta* L. Sp. pl. I (1753) 435; DC. Prodr. I, 692; Shmal'g., Fl. I, 200; Kom., Fl. Man'chzh. II, 61; Kom. and Alis., Opreedel. r. Dal'nevost. kr. II, 695; Sorn. r. SSSR, III, 245; Maevsk., Fl. izd. 7, 489. — Ic.: Jacquin, Oxalis, tab. 4; Rchb. Ic. Fl. Germ. V, tab. 199. — 79 Exs.: Fl. Gall. et Germ. exs. No. 119; Rchb. Fl. Germ. exs. No. 379; Fl. Ital. exs. ser. II, No. 1324 et No. 1324 bis.; Fl. Hung. exs. No. 231; Fl. polon. exs. No. 154.

Perennial; plant sparsely covered with white appressed hairs; root-stock thin, terete, creeping, with fleshy shoots; stems erect, simple or branching, 15–45 cm high, reddish to more or less reddish-purple, usually pubescent; leaves alternate, ternate, exstipulate, with petioles erect, round, villous, reddish, 2.5–6(8) cm long, jointed at base; leaflets obcordate, glabrous or sometimes pubescent, ciliate at margin, with 0.3 mm long pubescent petiolules. Floral scapes axillary, jointed at base, round, pubescent, 4.5–5 cm long, bracteoles at base of pedicels, numerous, lanceolate, acute, 1.5–2 mm long, 0.3 mm wide; pedicels 3–6(8) floriferous, 0.4–0.6 mm long, round, sparingly pubescent; calyx 4 mm long, nearly half as long as corolla; sepals lanceolate or oblong, 3–3.5 mm long, 0.7 mm wide, acute, erect, covered like pedicels with white straight hairs, ciliate at margin; corolla subcampanulate; petals yellow, 5.5–8 mm long, 1.5–3 mm wide, claw erect; limb spreading, oblong-obovate; filaments edentate, connate at base, the inner subglabrous or more or less sparsely hairy above, $1\frac{1}{3}$ times as long as the glabrous outer; anthers oblong, yellow, overlapping; ovary oblong, 2 mm long, 0.5 mm wide; styles nearly as long as inner filaments, pubescent; capsules oblong-columnar, pentagonal, 1.2–1.6(2) cm long, 1.8–2 mm wide, covered with hairs, obliquely upright on pedicels; seeds ovate, flattened, 1–1.3 cm long, 0.7 cm wide, acute above, brown, transversely ribbed. June–August.

Weedy places, gardens, orchards, fields, sands and gravels of river valleys, river bluffs. — European part: Balt., Lad.-Ilm., U. V., U. Dnp., M. Dnp., U. Dns., Bl., Crim.; W. Siberia: U. Tob. (near Kustanai); Far East: Uss. (introduced into Vladivostok, Vladivostok district and Novokievskoye in Pos'tet district). Gen. distr.: Centr., Atl. Eur., Med. (W.), Jap.-Ch., N. and C. Am. Described from Virginia. Type in London.

Section 2. ACETOSELLAE (Reiche) R. Knuth in Engl. Bot. Jahrb. L. Supplem. (1914) 229. — Div. Trifoliatae sect. Acetosellae Reiche in Engl. Bot. Jahrb. XVIII (1894) 281. — Perennials, with soft horizontal rootstock. Floral scapes 1-flowered; leaves radical.

3. *O. acetosella* L. Sp. pl. I (1753) 433; M. B. Fl. taur.-cauc. I, 354; DC Prodr. I, 700; Ldb. Fl. alt. II, 188; Ej. Fl. Ross. I, 482; Turcz. Fl. baic.-dah. I, 252; Boiss. Fl. or. I, 866; Shmal'g., Fl. I, 200; Kom., Fl. Man'chzh. II, 659; Kom., Fl. pol. Kamch. III, 208; Kom. and Alis., 80 Oprel. r. Dal'nev. kr. II, 695; Grossg., Fl. Kavk. III, 12; Kryl., Fl. Zap. Sib. VIII, 1839. — Ic.: Jacquin, Oxalis, tab. 80; Rchb. Ic. Fl. Germ. V, tab. 199; Sugawara, III. Fl. of Saghal. III, tab. 573; — Exs.: Pl. Finl. exs. No. 789; G. R. F. No. 659 et No. 1972; Herb. Fl. Reipubl. Sow. Ucr. No. 73; Fl. Pol. exs. No. 27; Fl. Stir. exs. No. 361 and No. 1193 (f. rosea); Fl. Gall. et Germ. exs. No. 1445; Fl. Boh. et Morav. exs. No. 355.

Perennial; plant 5–10 cm high, acaulescent, with creeping, thin, round rootstock often sparsely covered with ovate, acute, reddish, fleshy, scale-like small leaves; leaves exstipulate, all radical, green, ternate, with petioles 2–7 (10) cm long, thin, round, pubescent, jointed at base; leaflets obcordate, 1–2.5 cm long, 1.5–3 cm wide, subsessile, sparsely covered with appressed long white hairs, plicate longitudinally, bending at night. Scapes few, (2)5–7(10) cm long, axillary, longer than leaves; bracts disposed above middle of scape, 2.5–3 mm long, 1 mm wide, squamiform, lanceolate, obtuse; calyx 4–4.5 mm long, nearly one-third as long as corolla; sepals erect, oblong or lanceolate, acuminate, obtuse, 3–4 mm long, 1–1.5 mm wide, ciliate at margin, more or less pubescent, purple above; petals 5, white, sometimes with pink or violet nerves, often with yellow spot at base, 1.2–1.5 cm long, 0.5–0.7 cm wide, with claw erect and limb obovate, more or less spreading, slightly depressed, rarely petals pale purple or pinkish-purple or lilac-pinkish (var. *purpurascens* Mart.); filaments connate at base, the inner edentate, twice as long as the outer, all glabrous; anthers oblong, white, overlapping; ovary ovoid, 1.7–2 mm long, 1.5 mm wide; styles 5, glabrous, 6–7 mm long, three times as long as ovary; stigmas capitate; capsules ovoid or oblong-ovate, 0.8–1 cm long, 0.4–0.5 cm wide, acute, pale brown, glabrous, rugose; seeds ovate, acute, brown, 2.2 mm long, 1.5 mm wide, longitudinally ribbed, more or less shiny. May–June.

Forests, forest ravines, shrubby formations, subalpine meadows. — European part: Kar.-Lap., Dv.-Pech., Balt., Lad.-Ilm., U. V., V.-Kama, U. Dnp., U. Dns., M. Dnp. (vicinity of Kiev), V.-Don; Caucasus: Cisc., W. and E. Transc.; W. Siberia: Ob, U. Tob., Irt., Alt.; E. Siberia: Yenisei, An.-Say.; Far East: Kamch., Ze.-Bu., Uda, Uss., Sakh. Gen. distr.: Centr. Eur., Bal.-As. Min., Ind.-Him., Mong., Jap.-Ch., N. Am. Described from Europe. Type in London.

Note. *O. acetosella* also has small cleistogamous flowers on shortened peduncles in the summer.

81 Economic importance. The leaves contain Vitamin C 93 mg%, in September 121–144 mg%. They are sour (as in *O. corniculata*) and eaten as a vegetable and in soups (Grossg., Rast. res. Kavk., 38, 54).

4. *O. obtriangulata* Maxim. in Mélang. Biolog. VI, livr.3 (1867) 260 et in Bull. Acad. Sc. Pétersb. XII, 260; Kom., Fl. Man'chzh., III, 660; Kom. and Alis., Opredel. r. Dal'nev. kr. II, 695.— Ic.: Useful, Pl. Jap. III, tab. 779; Beih. Bot. Centralbl. XXXVII, 11, tab. 7; Kom. and Klob.-Alis. l. c. tab. 208, 2.— Exs.: G. R. F. No. 2355.

Perennial; plant acaulescent, subglabrous, rootstock 5–8 mm thick, covered with thin brown scalelike small leaves; leaves ternate, obdeltoid, 1.6–4 cm long, 2–5 cm wide, sharply truncate, acutely angled, the median slightly notched, the lateral rounded, green and glabrous above, beneath more or less glaucescent, sparsely white-appressed-hairy, more densely so along nerves, ciliate at margin, with 8–27 cm long, more or less rufous-hairy petioles. Floral scapes somewhat shorter than leaves, 8–18(21) cm long; bracts 2, in the upper part (nearly at base of calyx); scarious, lanceolate, 3–4 mm long, 1–1.5 mm wide, acute; calyx 8 mm long, half as long as petals; sepals lanceolate or oblong, obtuse, 7 mm long, 2 mm wide, glabrous; petals white, 1.6 cm long, 0.8 cm wide, with claws erect and limbs oblong-obovate, obtuse; filaments unequal, connate at base, glabrous, the inner $1\frac{1}{3}$ times as long as the outer; ovary oblong-oval, 3 mm long, 1.5 mm wide, with 5 sparsely pubescent to subglabrous styles slightly shorter than stamens; capsules cylindrical, erect, 2–3 cm long, 0.4–0.5 cm wide, long-acuminate, brown; seeds oval, acute, brown, 2.5 mm long, 1.5 mm wide, longitudinally ribbed. May–June.

Valleys of broadleaved forests, mixed (predominantly cedar) and mixed shady-forests; forest slopes.— Far East: Uda, Uss. Gen. distr.: Jap.-Ch. (Japan, Manchuria). Described from Posyet Bay near Post. Type in Leningrad.

Section 3. CERNUAE R. Knuth in Engl. Bot. Jahrb. L. Supplem. (1914) 225.— Plant with tubers, acaulescent or caulescent. Leaves usually radical. Floral scapes generally many-flowered.

5. *O. violacea* L. Sp. pl. I (1753) 434; DC. Prodr. I, 695.— Ic.: Jacquin, Oxalis, tab. 80; Bot. Mag. XLVIII, tab. 2215; Somoku Dzustusu, ed. 2, VIII, tab. 55; Britton and Brown, III. Fl. N. States and Canada, II, 345.

82 Perennial; plant acaulescent, with tuber simple, subglobose or ovoid, 0.8–1.5 cm long, 0.8–2.3 cm wide, and with fleshy whitish scales, often with reddish-lined sheaths; leaves ternate, petioles, 10–15(20) cm long, not jointed, terete, erect, weak, sparsely hairy, sometimes purplish in lower part; leaflets subsessile, broadly obcordate, 1–2.3 cm long, 2–3 cm wide, emarginate, glabrous, or sometimes more or less pubescent, somewhat ciliate at margin. Floral scapes erect, round, short-hairy, 9(17) cm long, as long as or slightly longer than leaves, 3–6- or many-flowered; bracts basal, lanceolate, acute, 2–2.5 mm long, 1 mm wide; pedicels round, jointed at base, pubescent, drooping before flowering, erect at anthesis; calyx 4–4.5 mm long, three times as long as corolla; sepals lanceolate or oblong-lanceolate, acute, 3–4(5) mm long, 0.7–1(1.5) mm wide, sparsely pubescent, ciliate at margin, erect, pale green, with 2 (rarely 1) oblong spot above; corolla campanulate; petals 1.3–1.4(1.5) cm long, 0.6–0.8 cm wide, with claw yellow and limb obovate, rounded, violet-purple, more or less striped, spreading; filaments connate

at base, the inner gibbose, denticulate, pubescent, equal, nearly twice as long as the outer, the outer glabrous, not gibbose; anthers oblong, white, overlapping; ovary oblong, 1 mm long, 0.5–0.7 mm wide, pale green, pubescent; styles short, 1 mm long, nearly half as long as outer stamens, densely pubescent. October.

Gardens. — Caucasus: W. Transc. (Sukhumi). Gen. distr.: Jap.-Ch. (Japan), N. Am. Described from Canada. Type in London.

Note. This is a N. American species, introduced into the Caucasus and locally escaped.

6. *O. pes-caprae* L. Sp. pl. I (1753) 434; Burm. Plant. African. (1738–1739) 80. — *O. cernua* Thunb. Diss. Oxalis (1781) 14; DC. Prodr. I, 696. — Ic.: Jacquin, Oxalis, tab. 6; Bonnier, Fl. Compl. Fr., Suisse, Belge, II, tab. 110. — Exs.: Fl. Ital. exs. No. 925; Fl. Gall. et Germ. exs. No. 2434; F. Schultz, Herb. Norm. No. 1741.

Perennial; plant with stem 5–10 cm long, creeping, rounded, glabrous, sparsely brown-scaly, tubers acuminate-ovoid, small, 7 mm long, 3 mm wide, glabrous, with brown sheaths; leaves many, petioles erect, jointed at base, round, glabrous, 8–27 cm long; leaflets ternate, obcordate, 1–2 cm long, 1.6–3.5 cm wide, deeply emarginate, often 2-lobed, glabrous. Floral scapes jointed at base, 18–30 cm long, erect, round, brown, with involucre (in upper part, below the numerous pedicels) of lanceolate-linear, acute, green, 2.5–4 mm long, 0.5–0.7 mm wide leaves; pedicels 1–2 cm long, round, 83 more or less pubescent, drooping before flowering and erect at anthesis; calyx 5–6(8) cm long, one-fifth to one-third as long as corolla; sepals lanceolate, 4.5–6(7) mm long, 1–1.3(2) mm wide, acute, erect, sparingly stiff-hairy, green, white-scarious and ciliate at margin, with 2 orange spots above; corolla campanulate, petals 1.5–3 cm long, 0.7–1.5 cm wide, with claw erect, pale yellow, and limb obovate, rounded, yellow more or less spreading; filaments glabrous, connate at base, the inner dentate, equal, twice as long as the outer; anthers oblong, overlapping; ovary 2.5 mm long, 1 mm wide, pubescent, with styles 1 mm long shorter than the outer pubescent stamens; capsules cylindrical, 1 cm long, 3 mm wide, pentagonal, mucronate, pubescent; seeds orbicular or more or less ovate and acutish, 0.7 mm long, 0.7 mm wide, brown, transversely ribbed. March.

Introduced into citrus plantations. — Caucasus: W. Transc. (Sukhumi). Gen. distr.: Centr. Eur. (Austria), Med., Ind.-Him. (India), Centr. Am., S. Afr. Described from Africa. Type in London.

Note. The name "*O. pes-caprae*" was given by Linnaeus to the yellow-flowered plant drawn in the work of Burman (Plant. African. (1738–1739) 80, tab. 29). The inflorescences depicted in this plate are a fine representation of what is now known as *O. cernua* Thunb.

O. pes-caprae was earlier regarded as a synonym of *O. caprina* L. Linnaeus' description of *O. pes-caprae* and the drawing attached cannot have any resemblance to the plant which Linnaeus himself later called *O. caprina*, and which is a weak plant with much smaller, pale lilac flowers. Hence, the type of *O. pes-caprae* is that drawn by Burman. There can be no doubt that this is the well-known species later described as *O. cernua* by Thunberg (T. M. Salter. Some Notes on the Correct Identity of *O. pes-caprae* L. — The Journ. of South African Botany, V (1939) 47–48).

Family ★ **TROPAEOLACEAE** * JUSS.

Flowers hermaphrodite, zygomorphic. Calyx 5-partite, colored, with a spur at base; petals 5, attached to base, entire, the upper two larger, the anterior 3-clawed; stamens 8, free; anthers bilocular; style 1, 3-partite at apex; ovary 3-lobed, 3-locular, with 1 ovule in each cell. Fruit separating into three-1-seeded nutlets with slightly fleshy rugose pericarp; seeds exalbuminous.

84 Genus ★ **TROPAEOLUM** ** L.

L. Sp. pl. ed. 1 (1753) 343; Buchenau in Pflanzenr. IV, 131 (1902) 20

Annual herbs with fleshy stems, strongly branching; leaves of the Russian species peltate, long-petioled, entire; flowers axillary, few, long-pedicceled.

1. *T. major* L. Sp. pl. ed. I (1753) 343; Over. and Sit., Opr. R. Kavk. flory, 356; Shmal'g., Fl. Yu.-Z. Rossii, 121. — Ic.: Bot. Mag. (1787) tab. 23; Bot. Gard. V (1834–1838) tab. 107; Bailey, Stand. Cycl. Hort. (1917) 3389.

Annual; stems long, smooth, juicy, weak, prostrate or twining, branching; leaves peltate, rotund, unequal-sided, obtusely nerved. Flowers large; spur slightly curved; the 3 anterior petals fimbriate at base of lamina orange with blood-red stripes. June–October.

There are cultivated races with dark red double flowers.

Native to South America, from Peru to Colombia. A garden favorite throughout the world for a long time. The flowers are slightly piquant and used in salads. The flower buds and green fruits are pickled like capers. The ripe fruits have a strongly laxative effect.

2. *T. minus* L. Sp. pl. (1753) 343; Buchenau in Pflanzenr. IV, 131 (1902) 21; Hegi, III. Fl. IV (1924) 3. — Ic.: Bot. Mag. (1793) tab. 98; Bot. Gard. IX (1839–1851) tab. 210; Bailey, Stand. Cycl. Hort. (1917) 3388.

Annual; plant smaller than the preceding; leaves smaller, orbicular, with nerves protruding at margins. Spur cylindrical, distinctly curved, upper petals obtusely acuminate, fimbriate at margin, yellow, maculate.

Native to South America: Peru. One of the common garden plants cultivated throughout Europe and America. In Europe it has been under cultivation since 1576. Its uses are the same as of the preceding species.

* Treatment by I.V. Palibin.

** From the Greek *tropheion*, trophy, due to the peltate leaves and helmet-like flower.

Family LXXXI. **LINACEAE** * DUMORT.

Dumort. Comment. bot. (1822) 61; Lineae DC. Prodr. I (1824) 423

Flowers hermaphrodite, regular, usually 5-merous; sepals free or
85 somewhat connate, imbricate, usually persistent; petals as many as sepals;
imbricate or crumpled, often very delicate; stamens as many as sepals
and petals or two to four times as many, all antheriferous or some stami-
nodes, the filaments usually dilated at base and adnate to tube (ring), nec-
tariferous; anthers motile, flexuose, introrse, opening by lateral slit; ovary
sessile, (2-3) 5-locular, often with false septa; ovules 1-2 in each cell,
anatropous; styles as many as carpels, free or more or less connate into
a column; stigmas different in shape. Fruit a capsule (Russian species),
1-seeded nutlet or drupe; seeds with slightly developed endosperm; embryo
straight. Herbs, semishrubs or shrubs, with alternate or rarely opposite
leaves and usually inconspicuous stipules (often in the shape of glands) or
exstipulate.

Key to Genera

1. Flowers 4-merous; annuals (1-10 cm high) 835. *Radiola* Roth.
- + Flowers 5-merous; perennials or annuals (usually larger)
- 836. *Linum* L.

Genus 835. **RADIOLA** ** Roth.

Roth. Tent. Fl. Germ. I (1788) 71

Flowers in furcately branching inflorescences (dichasia) and also
crowded in terminal pseudo-umbels, very small; calyx deeply 4-partite,
with 2-3-sect sepals; petals 4, very small and narrow, obtuse; stamens 4,
staminodes usually absent; carpels (and styles) 4; ovary 4-locular, each
cell divided by incomplete (false) septum into two 1-seeded sections;
stigmas capitate. Capsules globose; seeds small, flattened-obovate. Low
annuals, with sessile, opposite, entire leaves. One species only.

- 86 1. *R. linoides* Roth. Tent. Fl. Germ. II (1789) 199; Ldb. Fl. Ross.
I, 428; Shmal'g., Fl. I (1895) 181. — *Linum Radiola* L. Sp. pl. (1753)
281. — *L. multiflorum* Lam. Fl. Fr. III (1778) 70. — *L. tetrapeta-*
lum Gilib. Fl. Lithuan. V (1781) 144. — *Radiola dichotoma* Moench,
Meth. (1794) 288. — *R. Millegrana* Smith Fl. Brit. I (1800) 202. —
R. multiflora Aschers. Fl. Prov. Brandenb. II (1864) 28. — *R. radi-*
ola Karst. Deutschl. Fl. 2 Aufl. II (1883) 147. — Ic.: Svensk Bot. X
(1826-29) tab. 652; Rchb. Ic. Fl. Germ. VI (1844) tab. 325; Bonnier, Fl.
Compl. Fr. Suisse et Belge, II (1912) tab. 93. — Exs.: G. R. F. No. 57;
Woloszczak, Fl. polon. No. 714.

* Treatment by S. V. Yuzepchuk.

** Apparently derived from *radius* — ray; *radiolus* was the name given a plant by Apuleius.

Annual; plant wholly glabrous; root rather short, thin, whitish, branching; stems few, 1–10 cm high, erect or slightly ascending at base, cylindrical, often reddening, bearing below several pairs of opposite leaves and the rudiments of furcate branches at the very base; leaves sessile, ovate or oblong-ovate, acute, entire. Flowers generally many, in loose, usually much spreading regular leafy dichasia with leaves in pairs at nodes, distinctly crowded only at apices; sepals 4, proximally connate, 1–1.5 mm long, triangular-obovate, 3-toothed or 3-fid at tip; corolla with 4 small white shovel-shaped petals as long as calyx and short-clawed; staminodes present or often absent; styles 4; stigmas capitate; fruit a flattened-spherical, 4- (incomplete 8)-celled capsule; seeds flattened-ovoid, ca. 0.3 mm long, smooth, light brown, shiny. July–September.

Sandy banks of rivers, lakes, streams and other moist sandy places, fields, pastures, ditches, roadsides. — European part: Balt. (Latvian SSR), U. V., V.-Don, M. Dnp., Bl., L. Don. Gen. distr.: Scand., Atl. and Centr. Eur., Med., Bal.-As. Min. (Balkan Peninsula), N. and tropical Africa, temperate Asia. Described from Europe. Type in London.

Note. A rare, or usually overlooked, plant.

Genus 836. **LINUM*** L.

L. Spec. pl. (1753) 277

Inflorescence a dichasium, a spurious umbel, or sometimes a whorled or helical cyme; flowers rather large or small; sepals entire, very often glandular-ciliate at margin, the outer and inner sometimes unequal, usually persistent; petals deciduous, clawed, often connate at base, rounded at apex, of various colors (blue, red, pink, yellow, white); stamens 5, deltoid-dilated at base where adnate to tube (ring), with dentate staminodes disposed in between; nectaries 5 or less, at outer side of staminal tube; ovary 5-locular, (Russian species), often with incomplete pseudo-sepals, usually 10-ovuled (2 in each cell); style often free or connate to middle; stigma elongating or capitate. Capsules globose or ovoid; seeds flattened, smooth. Perennial or annual herbs, sometimes semishrubs; leaves sessile, more or less alternate, rarely opposite or whorled, usually entire; stipules gland-shaped or absent.

- 87 Not one of the systems proposed for this extensive genus (Planchon, Reiche, H. Winkler, H. Nestler) can be regarded as satisfactory or phylogenetic. Hence we group our species into the natural sections which can be distinguished within this genus, and place these sections in the somewhat provisory and arbitrary order following Planchon's monograph; however, unlike Planchon, we do not unite or separate them into larger units (sub-generic or, possibly, even generic), for this would be possible only after the whole genus has been monographically treated (obviously, as species-aggregates).

* The name for cultivated flax in ancient Rome.

1. Sepals eglandulose or ciliate at margin; flowers (Russian species) usually blue or sky-blue, rarely violet or white 2.
- + Sepals with (comparatively) few glands at margins (sometimes the innermost sepals without) or uninterruptedly glandular-ciliate; flowers of various colors (often yellow) 26.
2. Sepals long-acuminate; stigmas usually elongate (often linear) . . 3.
- + Sepals acute or obtuse (mostly mucronulate at apex); stigmas capitate 9.
3. Perennials, with lanceolate-long-acuminate, 3-5-nerved leaves; flowers heterogamous 4.
- + Annuals or biennials, rarely perennials, with linear acute 1-3-nerved leaves; flowers homogenous 5.
4. Plants 30-60 cm high, more or less loosely leafy; leaves terminating in very long mucro; inflorescence comparatively many-flowered, loose; sepals 1 cm long, in fruit nearly twice as long as capsule 1. *L. nervosum* W. et K.
- + Plants 12-25 cm high, leaves approximate, imbricate, terminating in a much shorter mucro or mucro absent; inflorescence poor, dense; sepals much shorter, in fruit hardly longer than capsule 2. *L. jaiilicola* Juz.
5. Perennial (rarely biennial) wild plants; flowers small, 11-16 mm in diameter; capsules small, 4.5-5 mm in diameter 3. *L. angustifolium* Huds.
- + Annual or biennial cultivated plants; flowers larger, 15-25 mm in diameter; capsules 5.5-7 mm in diameter 6.
6. Annuals, with capsules splitting and broadly dehiscing when ripe 4. *L. crepitans* Dum.
- + Capsules not as above 7.
7. Winter or semi-winter, rarely biennial plants, with stems prostrate or ascending before anthesis 5. *L. bienne* Mill.
- 88 + Annual spring plants, with erect stems 8.
8. Stem tall, 60-120(150) cm; leaves rather sparse; capsules mostly few, their septa usually glabrous; cultivated for fiber 6. *L. usitatissimum* L.
- + Stem low or of medium height, 30-50(70) cm; leaves dense; usually cultivated for oil 7. *L. humile* Mill.
9. Flowers homostylous; stamens and styles (at anthesis) nearly equal in length in all flowers 10.
- + Flowers heterostylous; stamens in flowers of some specimens with longer and in other specimens much shorter than style 15.
10. Fruiting pedicels (nearly) erect 11.
- + Fruiting pedicels distinctly nodding or drooping 12.
11. Root thick, robust; stems usually many, often ascending or prostrate; flowers rather large (ca. 2.5 cm in diameter); petals dark blue 8. *L. macrorrhizum* Juz.
- + Root thin, weak; stems few, erect; flowers small (up to 2 cm in diameter); petals pale blue or white 9. *L. pallescens* Bge.
12. Leaves mostly linear-lanceolate, rarely linear; petals sky blue or blue 13.
- + Leaves narrowly linear; flowers nearly violet (Altai plant) 11. *L. violascens* Bge.

13. Leaves obtuse; outer sepals mostly obtuse, the inner rounded at apex (Central Asian plant) 10. *L. mesostylum* Juz.
- + Leaves acute; outer sepals more or less acute, the inner acute or obtuse (Siberian and Far Eastern plants) 14.
14. Leaves often linear, glaucescent; stems usually without sterile shoots or stems very short; flowers 2 cm in diameter; sepals 2.5–4 mm long, blackish-dark-green; capsule usually brown 12. *L. baicalense* Juz.
- + Leaves often linear-lanceolate, bright green; stems with long densely leafy branches mostly in upper part; flowers and bright green sepals larger; capsule straw-yellow 13. *L. amurense* Alef.
15. Plants heterotristylous: specimens with long and short styles together with specimens with stamens and styles equal in length; Transcaucasian high-mountain plants, with low stems and few (1–3) flowers 14. *L. subbiflorum* Juz.
- 89 + Plants strictly heterodistylous, with only two kinds of flowers . . . 16.
16. Fruiting pedicels (nearly) erect 17.
- + Fruiting pedicels distinctly nodding or usually drooping 25. *L. austriacum* L.
17. Leaves 1–3(5)-nerved, usually spreading 18.
- + Leaves 1-nerved, (nearly) erect, often subappressed to stem. Crimean-Novorossiisk (mountain) species 25.
18. High mountainous or subarctic plants, mostly with acute or acuminate sepals 5–7.5 mm long 19.
- + Steppe plants, usually with obtuse (outer) or rounded and mucronate at apex (inner) sepals 3.5–5 mm long; leaves mostly glaucescent, 1–3-nerved 24.
19. Low plants of N. Urals, with obtuse bright green leaves and few (1–5) lilac-blue flowers 15. *L. boreale* Juz.
- + Other characters and distribution not as above 20.
20. Leaves bright green; flowers usually large, 3–4.5 cm in diameter; European, Siberian and Tien Shan plants 21.
- + Leaves glaucous or glaucescent; flowers smaller, 2.5–3 cm in diameter; Central Asian plants 23.
21. Leaves horizontally spreading 22.
- + Leaves usually erect-bulging (i. e., obliquely ascending), often even appressed to stem in lower part 17. *L. altaicum* Ldb.
22. Siberian plants, with more or less wide, very strongly acuminate leaves and very large flowers, up to 4.5–5 cm in diameter; sepals 7.5 mm long, petals blue 16. *L. komarovii* Juz.
- + European plants, with somewhat narrower and less strongly acuminate leaves; flowers smaller, up to 4 cm in diameter; sepals ca. 6 mm long; petals pale lilac-blue 20. *L. extraaxillare* Kit.
23. Lower leaves obtuse, often even rounded at apex; sepals blackish-green; petals very dark blue 18. *L. atricalyx* Juz.
- + Leaves very acute; sepals green or dark green (but not blackish); flowers lighter in shade 19. *L. turcomanicum* Juz.
24. Leaves up to 5 cm long; sepals 3.5–5 mm long, approximately one-fourth as long as petals; European-Siberian plants 21. *L. perenne* L. s. str.

- + Leaves shorter, usually not more than 2.5 cm; sepals 3–4 mm long, up to one-fifth as long as petals; E. Siberian plants 22. *L. brevisepalum* Juz.
25. Sepals 2.5–4 mm long, green; capsule 4.5–6 mm long, twice to three times as long as calyx 23. *L. euxinum* Juz.
- + Calyx much larger, 5–6 mm long, black-green; capsule ca. 8 mm long, only one and a half to twice as long as calyx 24. *L. marschallianum* Juz.
26. Leaves opposite (often only the upper alternate) 28. *L. catharticum* L.
- + All leaves alternate 27.
27. Annuals 28.
- + Perennials 31.
28. Flowers blue (white only as an exception); Far Eastern plant 26. *L. stelleroides* Planch.
- + Flowers yellow, rarely whitish; European, Caucasian and Central Asian plants 29.
29. Flowers small, 5–8 mm; petals short-clawed, free; leaves scabrous at margin 30.
- + Flowers comparatively large, 15–20 mm long; petals long-clawed, connate to form a tube; leaves denticulate at margin 40. *L. luteolum* M. B.
30. Leaves scabrous; sepals gradually acuminate, 4–5 mm long, with prominent midrib, beneath nearly keeled; petals yellow with darker claw; capsule acute 29. *L. corymbulosum* Rchb.
- + Leaves slightly scabrous at margin, smooth elsewhere; sepals abruptly tapering, 2–3 mm long, not keeled; petals pale yellow or whitish beneath; capsule obtuse 30. *L. gallicum* L.
31. Petals short-clawed, free, pinkish-white or pale lilac; leaves linear-setiform, shiny 27. *L. tenuifolium* L.
- + Petals long-clawed, connate in lower part to form a tube; leaves different 32.
32. Flowers yellow; leaves with stipular glands 33.
- + Flowers sky blue or reddish-pink; leaves without stipular glands 41.
33. Mostly low semishrubs, 6–35(50) cm high, with strongly branching rachis, common in mountains and rocky outcrops 34.
- + Higher (20–60 cm) steppe herbs, with rachis slightly branching or not at all 39. *L. flavum* L.
34. Rosettes of radical leaves absent at anthesis; cauline leaves distinctly mucronate at apex; sepals very long, nearly twice as long as capsule 31. *L. orientale* Boiss.
- 91 + Rosettes of radical leaves usually present (rarely absent); cauline leaves not mucronate at apex; sepals shorter. 35.
35. Glabrous plants 36.
- + Plants densely covered with short spreading hairs 40.
36. Sepals rather long, 5–9 mm, tapering to long mucro at apex, much longer than capsule (at least the mucro exceeding capsule) 37.
- + Sepals short, 4–6.5 mm, tapering to a short mucro at apex, usually not longer than capsule 39.

37. Leaves of radical rosettes more or less broadly spatulate, persistent; cauline leaves oblong-obovate to lanceolate; Crimean-Caucasian plant 32. *L. tauricum* Willd.
 + Leaves of radical rosettes narrowly spatulate, often withering at anthesis; upper cauline leaves oblong or sublinear 38.
38. Cauline leaves oblong-elliptic, 3-nerved, distinctly 5-nerved below 35. *L. basarabicum* (Savul. et Rayss) Klok.
 + Cauline leaves sublinear, 1-nerved
 34. *L. linearifolium* Javorka.
39. Radical leaves narrowly spatulate or oblanceolate; cauline leaves usually linear-lanceolate; inflorescence loose, with elegant, thin branches; capsules tapering to short but distinct beak at apex 38. *L. uralense* Juz.
 + Leaves wider; inflorescence compact, with short thick branches; capsules tapering at apex into a short indistinct beak.
 38. *L. uralense* Juz.
40. Sepals rather long, 5–9 mm, noticeably longer than capsule; Crimean plants 33. *L. pallasianum* Schult.
 + Sepals shorter, 4–6.5 mm, not longer than capsule; Ukrainian plants 37. *L. czerniaëvii* Klok.
41. More or less pubescent European and Caucasian plants; all sepals glandular-ciliate at margins; stigmas elongate, linear 42.
 + Completely glabrous Central Asian plants; inner sepals with a single gland or eglandulose at margins; stigmas globular-capitate 44.
42. High mountainous plants, with bright green leaves and pale purple flowers 41. *L. hypericifolium* Salisb.
 + Foothill and steppical plants, with gray-green leaves and pale blue flowers 43.
43. Plants sparingly to rather densely pubescent; leaves up to 12 mm wide; 3–5-nerved, obtuse or acute; S. Russian plants (mainly Ukrainian), steppe 42. *L. hirsutum* L.
 + Plant very densely pubescent; leaves narrower, usually 3-nerved, obtuse; Crimean-Novorossiisk, generally mountainous plant 43. *L. lanuginosum* Juz.
- 92 44. Root short, strongly branching; stems usually few, mostly erect; leaves up to 10 mm wide, acute; inflorescence mostly many-flowered, dense; petals gradually tapering to comparatively short claw 44. *L. heterosepalum* Rgl.
 + Root long, weakly branching; stems usually many, ascending; leaves narrower, obtuse; inflorescence generally few-flowered, loose; petals abruptly tapering to very long claw 45. *L. olgae* Juz.

Section 1. PROTOLINUM Planch. in Lond. Journ. of Bot. VI (1847) 597. — Flowers usually large; fruiting pedicels elongate; sepals eglandulose at margin, more or less acute; petals free, blue, pink or white; stigmas longer than wide, clavate or linear. Perennials, biennials or annuals, with virgate branches and alternate leaves without stipular glands.

Series 1. *Nervosa* Juz.— Leaves lanceolate, 3–5-nerved. Flowers heterogamous, dimorphic. Perennials.

1. *L. nervosum* Waldst. et Kit. Pl. rar. Hung. II (1805) 109; Ldb. Fl. Ross. I, 424; Shmal'g., Fl. I, 183.— *L. nervosum* β . *glabratum* DC. Prodr. I (1824) 426.— Ic.: Waldst. et Kit. l. c. tab. 105; Rchb. Ic. Fl. Germ. VI, tab. 332.— Exs.: Fl. exs. austro-hung. No. 2462; Dörf. Herb. Norm. No. 4852.

Perennial; bright green or glaucescent plant; root rather long, cylindrical, whitish, woody as caudex; stems few, 30–60 cm high, 1.5–3 mm in diameter, erect or ascending at base, cylindrical, slightly sulcate when dry, pale green, glabrous or pubescent at base or for nearly the entire length, glabrescent in inflorescence, densely leafy in lower part, sparingly so above; sterile shoots more densely leafy, short or half as long as the fertile ones; leaves 0.8–4 cm long, 2–12 mm wide, sessile, usually ascending, rarely spreading, lanceolate, suborbicular at base, very acute, stiff and strict, cartilaginous, entire or scabrous at margin, with 3–5 prominent nerves (Russian plants often completely glabrous — f. *glabratum* DC. — or rarely more or less densely covered with loosely intertwined or spreading shortish hairs ("type" form)) at both sides or only beneath upper leaves with thin, slightly spiny, colorless, brittle mucro; lowermost leaves much smaller, squamiform. Inflorescence occupying the upper one-fifth to one-third of stem, with branches obliquely antrorse, few-flowered; flowers ca. 2 cm in diameter; sepals 0.8–1 cm long, lanceolate, with spiny mucro, 3–5-nerved, somewhat furcately ciliate from the middle upwards, with small short stalked glands; petals up to 2 cm long, orbicular-obovate, sky blue, with pale or yellowish claw; long stamens and styles 8–10 mm long, short stamens and styles 5–6 mm long; anthers large, ovate, 5–7 mm long; stigmas linear; capsules usually almost half as long as sepals, rarely (nearly) as long (see Note); seeds ca. 3 mm long, narrowly ovoid, with curved beak, brown. June.

Dry meadows, steppes, steppe ravines, stony mountainous slopes, limestone along riverbanks, sparse pine forests, edges of oak forests and forest meadows.— European part: M. Dnp., V.-Don, Crim.; Caucasus: Cisc., Dag., E., W. and S. Transc. Gen. distr.: Centr. Eur. (Hungary), Bal.-As. Min. (Balkan Peninsula). Described from Hungary. Type in Budapest.

Note. The inclusion of the Transcaucasian and some of the Crimean (steppe) forms in this species is rather inconclusive. Very often plants with sepals shorter than in the type form, which do not or hardly exceed the ripe capsule, have been observed, differing also by the glaucous color of the leaves; these characters are given as distinguishing ones for the *Asia Minor L. aucheri* Planch. (in Hook. Lond. Journ. Bot. VII (1848) 133). The Caucasian and Crimean specimens, with a similar combination of characters, have been repeatedly referred to the latter species (Grossgeim, Flora Kavkaza, v. III, 1932, p. 14; Wolf in schedis). Until further investigation we have to regard *L. aucheri* as a very critical taxon, whose specific independence and occurrence in the USSR require confirmation.

2. *L. jailicola* Juz. nov. spec. in Addenda XIII, 713.— *L. nervosum* auct. fl. taur. p. p.; Shmal'g., Fl. I, 183, p. p.

Perennial; stems 12–25 cm high; leaves very approximate, suberect, imbricate, much shorter and narrower than in *L. nervosum* W. K.,

0.5–3 cm long, 1.5–6 mm wide, with or without a very short mucro. Inflorescence unbranched or with few short branches, contracted; flowers 1–5, rather small; sepals 5–6 mm long, relatively wide, terminating in short mucro, in fruit hardly as long as capsule or slightly longer; petals ca. 1.5 cm long. Similar to *L. nervosum* W.K., in other characters being apparently a related local race. June–July.

- 94 Mountainous meadows, slopes. — European part: Crim. (Yaila); Caucasus: E. Transc. (Novorossiisk district, Markokht Range). Endemic. Described from the Crimea. Type in Leningrad.

Note. This is a somewhat problematic species which should be investigated under cultivation together with the steppe *L. nervosum* W.K. *L. jailicola* should also be compared with *L. aucheri* Planch., as noted above in the Note on *L. nervosum* W.K.

Series 2. *Angustifolia* Juz. — Leaves linear or linear-lanceolate, 1–3-nerved. Flowers homogenous (homomorphic). Annuals, perennials.

Note. From a practical point of view this most important group, to which cultivated flax belongs, is represented here by cultigen derivatives of the wild *L. angustifolium* Huds. Of the special works on the systematics of cultivated flax, treated very generally in the present volume, the following two are noted:

1) E. Schilling, *Botanik und Kultur des Flachses. Technologie der Textilfasern*, V (1), 1930. We are not going into great detail in dealing with this work.

2) E. V. Elladi, *Linum usitatissimum* (L.) Vav. consp. nov. *Len. Kul'turnaya Flora SSSR*, V. p. I (1940) 109–207. The taxonomy of cultivated flax based on extensive data is treated in this work. However, its value is limited by many factors. The nomenclature accepted by the author cannot stand up to criticism and contradictory to the International Code of Botanical Nomenclature. The names *L. dehiscens* and *L. indehiscens* are irregular and superfluous. Synonyms of established and distinguished forms are missing. For this reason Elladis' attitude towards those forms established by earlier authors remains quite ambiguous. Furthermore, together with subspecies and "proles" there is a multitude of "varieties" and "subvarieties" which are the result of an arbitrary choice of taxonomically insignificant characters and only obscure the proposed system; we therefore ignore them. Data on the distribution of some forms are undocumented and there are no references to specimens investigated or reports on where they are preserved. Finally, a key to the subspecies or "proles" distinguished by him is lacking, which makes it more difficult to use his treatment.

- 95 3. *L. angustifolium* Huds. *Fl. Angl.* ed. 2 (1778) 134; *Planch. Journ. of Bot.* VII, 167; *Boiss. Fl. or.* I, 861, *Suppl.* 139; *Trautv. Increm. phaen.* *Fl. Ross.* in *Tp. B. C.* VIII, 159; *Shmal'g., Fl.* I, 185, p.p. —? *L. pyrenaicum* Pourr. *Act. Toulouse*, III (1788) 322. — *L. marginatum* Poir. *Dict. Suppl.* III (1813) 443; *Ldb. Fl. Ross.* I, 425. — *L. agreste* Brot. *Fl. Lusit.* I (1804) 481. — *L. hispanicum* F.N. Williams, *Prodr. Fl. Brit.* IV (1912) 485, *vix autem* Mill. — *L. usitatissimum* subsp. *angustifolium* Thell. *Fl. adv. Montp.* (1912) 36. —

L. usitatissimum subsp. *hispanicum* Thell. in Fedde Repert spec. nov. XI(1912) 75, vix autem *L. hispanicum* Mill.— *L. dehiscens* subsp. *angustifolium* Vav. et Ell., Kul't. Fl. V (1940) 111.— Ic.: Sowerby et Sm. Engl. Bot. VI (1797) tab. 381; Rchb. Ic. Fl. Germ. VI (1844) tab. 326.— Exs.: Rchb. Fl. exs. Germ. 1998; Schultz, Herb. Norm. 450; Billot, Fl. Gall. et Germ. exs. 1144.

Perennial; sometimes biennial; glabrous plant with woody caudex covered with fibrous relics of the previous year's stems; stems 20–60 cm high, many, rarely few or even solitary, usually ascending, rarely erect, elegant, much leafy, furcately branching above, glaucous with waxy bloom, violet at base; non-flowering stems short, densely leafy, usually decumbent; leaves small, usually ca. 1.5 cm long, 1 mm wide, narrowly lanceolate or linear-lanceolate, tapering at both ends, nearly spinescent at apex, scabrous at the sometimes reflexed margins, 3-nerved, grayish-green; lower leaves shorter and very close. Flowers few, at ends of branches, with very thin pedicels markedly elongating post-anthesis, 11–16 mm in diameter, homogenous; sepals ovate, acute, acutely keeled, 1-nerved, white-membranous at margin, dentate-ciliate, in fruit not as long as capsule; petals almost twice as long as sepals, rounded at apex, very delicate, pale blue or pale violet; anthers short, 1.25–1.5 mm long, blue; capsules 5–6 mm long, 4.5–5 mm wide, globulose-ovoid, acute, about as long as calyx, splitting and broadly dehiscent when ripe, easily falling off; false septa with long dense cilia at the inner margin; seeds small, short, 2–3 mm long, 1.5–2 mm wide, not more than twice as long as wide, beakless or with an obsolete beak, pale brown, very shiny, dispersed from capsule. April–June.

Light dry forests and shrubby formations, dry meadows and pastures, edges of fields and fallow land. — European part: Crim.; Caucasus: Cisc., W. and E. Transc., Tal. Gen. distr.: Atl. Eur., Med. (from N. Africa), Bal.-As. Min. Described from England. Type in London.

Economic importance. *L. angustifolium* was undoubtedly cultivated in the Mediterranean countries in ancient times but it is of no great value in modern cultivation. There can be no question however that all cultivated strains of flax have been derived from this species, to which (and only to which) they are closely related and with which they are easily crossed. Due to this factor the species is of interest in selection.

Note. Britten (Journ. Bot. L. 1912) convincingly established the legitimate name *L. bienne* Mill. (Gard. Dict. ed. 8 (1769) no. 8) for this taxon; in the present work we have accepted this name but in a different sense (see Note to *L. bienne* Mill. below).

4. *L. crepitans* Dum. Fl. Belg. (1827) 111.— *L. usitatissimum* β . *crepitans* Boenn. Prodr. fl. monast. Westph. (1824) 94; Shmal'g., Fl. I, 184.— *L. dehiscens* subsp. *crepitans* Vav. et Ell., Kul't. Fl. V (1940) 113.— *L. humile* Planch. Lond. Journ. of Bot. VII (1847) 165, p. p. vix autem Mill.— Ic.: Rec. Trav. Bot. Neerl. VIII (1911) tab. 3; Kul't. Fl. V, l. c. (1940) 116, f. 49 et 50.

Annual; stems solitary, comparatively low, 20–60 cm high, erect, covered (like leaves) with distinct waxy bloom, with anthocyanin at base when mature, densely leafy; leaves larger and wider than in *L. angustifolium* Huds.

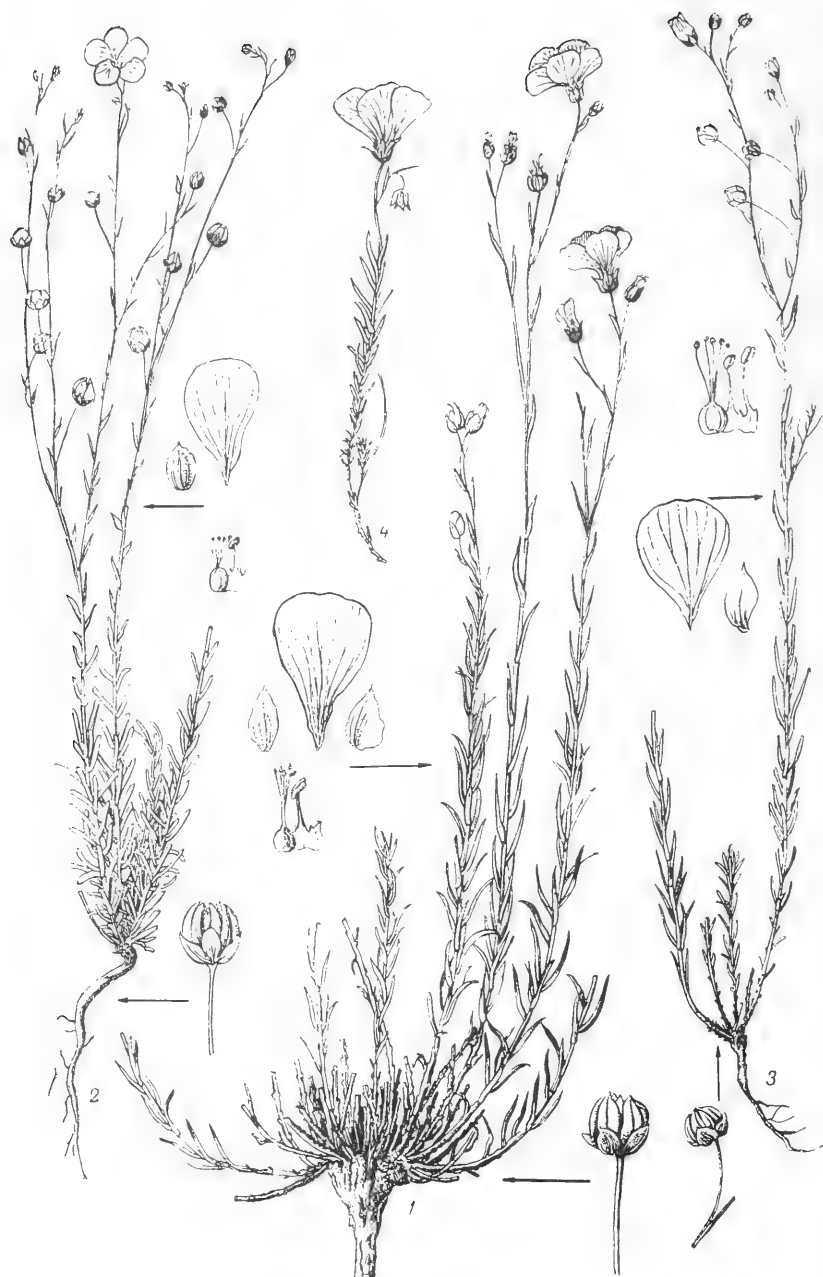


PLATE VI. 1 - *Linum macrorrhizum* Juz., habit, sepals, petals, stamens, pistils, capsule; 2 - *L. pallescens* Bge., habit, sepals, petals, stamens, pistils, capsule; 3 - *L. baicalense* Juz., habit, sepals, petals, stamens, pistils, capsule; 4 - *L. subbiflorum* Juz., habit.

Flowers 10–18 mm in diameter; sepals wide, obtuse; petals pale violet, somewhat more intensively colored than in *L. angustifolium*; capsules 7–7.7 mm long, 6–7 mm in diameter, conoidal, rigid, coarse, with anthocyanin before ripening, later splitting, broadly dehiscent, finally falling off easily; septa glabrous at margins (without cilia); seeds larger, 4–5 mm long, 2–2.7 mm wide, more flattened than in common flax (*L. usitatissimum* L.), with an obsolete beak, brown, dispersed from capsule. Otherwise resembling *L. angustifolium* Huds. and *L. usitatissimum* L. June–August.

Cultivated for itself or mixed with common flax. — European part: M. Dnp. and other parts. **Gen. distr.:** Atl. and Centr. Eur. Described from Belgium. Type unknown.

Economic importance. Although the plant yields abundant fiber it is unsuitable for cultivation because its seeds are so easily scattered. It is for this reason that it is disappearing from cultivation.

Note. *L. crepitans* is usually accepted as a "variety" of *L. usitatissimum* L. which is phylogenetically wrong because it is obviously a derivative of *L. angustifolium* Huds. and is completely 99 independent of *L. usitatissimum*. Its original region is probably the Pyrenees.

5. *L. bienne* Mill. Gard. Dict. ed. 8 (1768) No. 8. — *L. africanum* hort non L. — *L. usitatissimum* 2 hyemale romanum Heer, Pfl. Pfahlbauten (1865) 35. — *L. usitatissimum* A. vulgare II. *bienne* Asch. et Graebn. Synops. VII (1914) 220. —? *L. Catanense* Strobl. in Ö. B. Z. XXXVI (1886) 162. — *L. indehiscens* subsp. *eurasiaticum* prol. *prostrata* Vav. et Ell., Kul't. Fl. V (1940) 171. — Ic.: Kul't., Fl. V, l. c. (1940) p. 172, f. 89; p. 173, f. 90.

Winter or mid-winter annuals, rarely biennials; stems few or many, of medium height, prostrate or ascending before anthesis, floral shoots erect from ascending or curved base, glaucous, densely leafy; flowerless stems; reduced; leaves small. Flowers 1.5–2.4 cm in diameter; petals broadly obovate to suborbicular, falling soon, sky blue or pale blue; anthers usually blue; fruit ca. 6–8 mm long, 5.5–6.5 mm wide, acuminate, without or slightly colored with anthocyanin before ripening, indehiscent (sometimes slightly splitting at beak); septa glabrous or sometimes ciliate at margin; seeds small, brown. Otherwise resembling *L. usitatissimum* L. (see below). June–August.

Fields (cultivated). — Caucasus: W. Transc. (Abkhazia), Tal.

Gen. distr.: Med., Bal.-As. Min., sometimes Atl. and Centr. Eur. (Bavaria). Described from Istria. Type unknown (perhaps in London).

Economic importance. The plant is cultivated for its fiber. Subtropical cultivation in Europe has been successful only in its southern and Atlantic parts where the winters are mild and there is snow cover.

Note. The forms included here are the most primitive type of cultivated flax and the closest to the wild *L. angustifolium* L.; they resemble the latter in habit, small leaves, capsules, seeds and also their life cycle, but they sharply differ from it (as they differ also from *L. crepitans* Dum.) by the capsules not splitting when ripe. *L. bienne* appears to be the ancestor of our common flax, the forms of which are described below under the names *L. usitatissimum* L. and *L. humile* Mill.

There is reason to believe that in the primitive times of lake-dwelling the cultivated flax was specifically winter flax with stems prostrate before anthesis, i. e., *L. bienne* (there are differences of opinion on this). In the nomenclature of the winter flax we are following Schilling. We note however that Britten (*Journ. of Bot. L* (1912) p. 246) identified *L. bienne* 100 Mill. with *L. angustifolium* Huds., giving priority for Miller's name. His motive in doing so appears to us to be inadequate and was based on Planchon, who had seen Miller's plant at the Banks herbarium and referred it to *L. angustifolium* Huds. Britten did not re-examine Miller's original. However, in the description of his plant Miller did not mention the more typical characters of *L. angustifolium*, in particular the splitting of the capsules and to what extent. Moreover, Miller, who grew *L. bienne* for many years, recommended it for future cultivation, which could hardly be the case if a plant like *L. angustifolium* were being discussed.

6. *L. usitatissimum* L. *Spec. pl. ed. 1* (1753) 277 s. str.; Ldb. *Fl. Ross. I*, 425, p.p.; Shmal'g., *Fl. I*, 183, p.p.—*L. usitatissimum* α . *vulgare* Bönningh. *Prodr. Fl. monast. Westph.* (1824) 94; Shmal'g., *l. c.* 184.—*L. usitatissimum* α . *indehiscens* Neilr. *Fl. Nieder-Oesterr.* (1959) 864.—*L. usitatissimum* α . *typicum* Pospich. *Fl. Oesterr. Küstenl. II* (1898) 8.—*L. indehiscens* subsp. *eurasiaticum* proles *elongata* Vav. et Ell., Kul't. *Fl. V*, 1 (1940) 153.—*l. c.*: Sowërby et Sm. *Engl. Bot. XIX* (1804) tab. 1357; Rchb. *l. c.* *Fl. Germ. VI* (1844) tab. 329.—*Exs.*: Tausch, *Herb. Bohem.* 255; Meinsh. *Fl. Ingr.* 129b.

Annual; main (tap) root rather short, whitish, with a few larger rudimentary branchings but with several thin rootlets; stems 1 (3), usually high, 60–120 (150) cm, upright and erect, cylindrical, thin, often simple, branching only in upper part (in inflorescence), pale green, with faint waxy bloom; anatomically characterized by strongly developed bast fibers or, more precisely, bundles disposed at the periphery of the central cylinder, separated from each other by layers of parenchyma and composed of so-called "hard bast," the whole layer easily detached from the wood (bast fibers are formed by the pericycle and not by the cambium the activity of which is here suppressed); leaves numerous, relatively not dense, spirally disposed, 2–3 cm long, 3–4 mm wide, linear or linear-lanceolate, the largest lanceolate, acute, tapering at base, sessile, slightly glaucescent with rather weakly developed waxy bloom, smooth, 3-nerved at margin. Inflorescence a loose bostryx, sometimes passing into a cyme, with lanceolate bracts; flowers comparatively few, usually medium-sized or rather small, 1.5–2.4 cm in diameter, on peduncles longer than calyx, jointed then thickened at apex; sepals 5–6 mm long, herbaceous, persistent in fruit, ovate or ovate-lanceolate to oblong-ovate, the inner wider, acute or short-acuminate at apex, acutely keeled, 2–5-, usually 3-nerved; with margins 101 white-scarious, scabrous towards apex, finely ciliate; petals 12–15 mm long, cuneately obovate, somewhat rounded-tapering at apex or obtuse, entire or slightly crenate, smooth or somewhat wrinkled, sky blue or blue with darker nerves, rarely white, pink or reddish-violet, tapering to white claw yellow at base, falling soon; stamens with linear dark blue filaments, white in upper part, staminal tube short, annular; anthers oblong, usually

blue, rarely yellow or orange; staminodes triangular, sometimes inconspicuous; ovary ovoid, green; style with cuneate-linear stigmas, dark blue to violet; capsules 6–8 mm long, 5.7–6.8 mm in diameter, flattened-globose or globose-ovoid, with small mucro at apex, yellowish, usually without anthocyanin, slightly colored only before ripening, not splitting; false septa glabrous or rarely ciliate; seeds commonly 10, sometimes less, 3.3–5 mm long, ovoid or oblong-elliptic, much flattened, slightly unequal-sided, rounded at base, acute at apex, pale brown to dark brown, rarely greenish-yellow, quite smooth, shiny. June–July; strains ripening early or at mid-season.

Fields as a spring plant, sometimes occurring (mixed) among other crops; rubbish dumps, roadsides, near dwelling places as an accidentally escaped plant. Predominantly in argilloarenaceous and loamlike soils, under conditions of a comparatively moist and warm climate, ranging from the western border of the USSR to the Pacific Ocean, from 62–63°N to 50–55°N. —

European part: especially in Balt., Estonia, Latvia and Lithuania, Kar.-Lap., Dv.-Pech., Lad.-Ilm., U.V., U.Dnp., V.-Don, V.-Kama; W. Siberia: Ob, Alt.; E. Siberia: Ang.-Say., Dau. Gen. distr.: typical form mainly in Atl. and Centr. Eur., Scand., Bal.-As.Min. (Yugoslavia); in other countries of the Old World, mainly other related races. Described from S. Europe. Type in London.

Economic importance. The popular *L. usitatissimum* has been cultivated in the USSR for many years, mainly for fiber, sometimes for oil (for the latter purpose *L. humile* Mill., or the so-called low-flax, is more often grown — see below).

"Bast" (or "technical") fibers comprise bundles of many "elementary" fibers (cells) united by pectin. The fibers are (0.4)2–3(10) cm long and ca. (1)20–30(200) microns wide. The considerable length and thickening of the wall of the elementary fibers determine the high quality of the flax and make it a first class textile plant. The length of the "technical" fibers (i. e., bundles of cells) is 40–140 cm. The features of the stem structure facilitate the processes which it undergoes after harvesting: soaking (maceration) and mechanical processing (releasing "technical" fibers).

In 1936 there were 146,700 ha of *L. humile* under cultivation in the USSR, which represented about 80% of the total world area of flax fiber. Its peculiarities and uses are well known.

Note. *L. usitatissimum*, in the broad, general sense, is extremely polymorphic and undoubtedly an aggregate species. Even after the separation of *L. crepitans* Dum. and *L. bienne* Mill. it is fairly heterogenic and may be separated into a series of races, based on both geographical and selection (according to its double economic use) aspects. With respect to the geographical distribution, the area of most of these species is outside the USSR. The spring flax with its splitting capsules is cultivated in the USSR and belongs essentially to one geographical type. A flax with slightly larger capsules is grown in the Crimea, and although it is close to the Mediterranean race it apparently cannot be identified with it.

It is for this reason that the separation of Russian flax into two groups of forms is of great importance: one group cultivated for fiber — *L. usitatissimum* *L. sensu strictu* (common flax), to which the above-described species and its geographical area are referred — the other cultivated for oil. The oil group includes *L. humile* Mill. and also the

more or less primitive forms which occupy an intermediate position between *L. usitatissimum* L. s. str. and *L. humile* Mill. but are more related to the latter species. We preferred to separate all these forms from *L. usitatissimum*.

7. *L. humile* Mill. Gard. Dict. ed. 8 (1768) No.2.— *L. usitatissimum* auct. plur. p.p.; Ldb. l. c. p.p.; Shmal'g., l. c. p.p.— *L. usitatissimum* β . *humile* DC. Prodr. I (1824) 426.— *L. Hohenackeri* Boiss. Diagn. ser. II, 1 (1847) p. 97.— *L. indehiscens* subsp. *eurasiaticum* proles *brevimulticaulia* (sic!) Vav. et Ell. ex Elladi in Kul't. Fl. V, 1 (1940) 162.— Ic.: Artus, Atl. Pharm. Deutschl. Aufl. Offic. Gew. (1862–1874) tab. 47; Elladi, l. c. f. 79–87.

Annual; root system stronger than in the typical *L. usitatissimum*; bushy plant, with 2 to few stems (rarely, in dense stands, stems solitary), low or medium in height, 30–50(70) cm, anatomically characterized by the suppressed bast layer and the strong development of the wood (the result of intensified activity of the cambium); leaves more dense than in *L. usi-*
103 *tatissimum*. Flowers more or less like in the latter (often slightly larger, with emarginate petals); capsules usually many, generally not larger or slightly larger than in *L. usitatissimum*, dark or light brown; septa of capsules (in the Russian forms) often ciliate, rarely glabrous; seeds 5–6.3 mm long, dark or light brown. Otherwise similar to *L. usitatissimum* L. June, July; mostly late ripening forms.

Habitat just as in the preceding but tolerates a warmer and more arid climate, grows well in chernozem and chestnut soils. — European part: M. Dnp., V.-Don, V. Kama, Transv., L. V., Crim.; Caucasus: Cisc, Dag., W. and E. Transc.; W. Siberia; Ob, Alt.; Centr. Asia: nearly everywhere. Gen. distr.: Atl. and Centr. Eur., Bal.-As. Min. (rarely), Iran., Dzu.-Kash., Jap.-Ch. Described from Europe. Type probably in England.

Economic importance. *L. humile* is usually cultivated for its oil (seeds contain 42–45% oil). Intermediate forms between it and *L. usitatissimum* are used, or may be used, for fiber. The oil is often used for food but its primary use is in the preparation of such technical products as varnish, drying oil, paints, water-resistant fabrics, linoleum, etc. It is also an officinal plant. It contains oleic acid, which easily combines with oxygen, and rapidly condenses, all of which give the plant its high technical qualities. It also readily combines with iodine; the iodine number of common flax is higher than that of low-flax, but the percentage of oil in the seeds of low-flax is higher than in the common which makes it superior to the latter as an oil plant. Oil-cakes are an excellent fodder for dairy cattle and the chaff yielded by the crushed capsules serves as fodder for pigs.

Note. Planchon, in his monograph, apparently accepted without any basis *L. crepitans* Dum. as *L. humile* Mill.

Section 2. **ADENOLINUM** [Rchb. Handb. (1837) 305 pro gen.] Planch. l. c. (1847) 597. — Inner sepals obtuse; petals blue, lilac or white; stigmas capitate. Perennials. In all other parts similar to the preceding section.

Note. In the flora of the USSR, the *Adenolinum* group is undoubtedly the most polymorphic and taxonomically the most complex (and also the

most difficult) group in *Linum* L. In the West it has been a subject of interest for many years and therefore has been more than adequately investigated. In the USSR the situation is different, notwithstanding the fact that here the group is far richer than in the W. European countries, but it has not received the attention it deserves. It is true that Bunge treated the group in "Flora Altaica" (1829), which was brilliant for its time, distinguishing within that flora three different species of *Adenolinum*. In Alefeld's "Ueber *Adenolinum* Rchb." (*Botanische Zeitung*, 25 Jahrg. (1867) pp. 249–255), published in 1867, the Russian forms are treated extensively with a great deal of additional new and important data. Neither of these works, however, received the credit due to them. Alefeld's work was not even noticed by Russian botanists, with the result that the overwhelming majority of the representatives of the group were erroneously treated as Linnaeus' *Linum perenne*, or in the best case presented as "varieties" of the latter. The cause for this situation is the uniform habit of the component taxa of the group. They are not effectively distinct, their distinguishing characters cannot be detached in a superficial observation and for easy determination only good and complete collections are needed. A reliable key to the species in the subsection is given by Alefeld in his work, despite its incompleteness and inaccuracies. He was the first, and the only one to date, to focus due attention on the taxonomic significance of the character of the heterostyly for the whole group, distinguishing in it, on the one hand, dimorphic forms or, more precisely, heterodistily, i. e., flowers in some of the specimens being "long-styled" (and with short stamens) and in others, short-styled (and with long stamens), and on the other hand, trimorphic or heterotristily. In the latter case, besides specimens with either of the above two forms of flowers, there are also flowers with styles and stamens of the same length, i. e., "medium-staminal." According to these two groups Alefeld classified all the species known to him. In addition to the heterostyly, he outlined (as had been done before him) the proper significance of the character of the position of fruiting pedicels in order to identify individual species. The principles represented by Alefeld in the classification of the species of subsection *Adenolinum* are adopted in the present treatment. We have deviated from Alefeld's scheme by our recognition of the existence within the subsection, of still another group (obviously, the most primitive) of homomorphous (homostyly) flax, i. e., flax without heterostyly and possessing only one kind of flower, "medium-staminal." We have included in this group many species which Alefeld unjustifiably regarded as trimorphic (and in part as dimorphic). Two of the above-noted groups can be easily separated, in our flora, into two specific series, characterized by the direction of the fruiting pedicels. The taxa consisting of these series are vicarious (or geographical) species. We have eventually established a system, as proposed below, which is natural and reflects to a certain extent the real relationships within the groups. We readily admit the possibility of polyphyletic origin of some of the series (and even subseries) accepted by us, notably in the group of dimorphic or heterodistily flax.

Group 1. *Homomorpha* Juz. — Flowers always regular, homogonous; styles about as long as stamens.

Series 1. *Pallescentes* Juz. — Fruiting pedicels erect.

8. *L. macrorrhizum* Juz. nov. sp. in Addenda XIII, 714.

Perennial; root vertical, robust and long, woody, covered above with dead stems of the previous year; floriferous stems usually many, (1)4–20, 8–27 cm high, cespitose, erect or often ascending even nearly prostrate, straight or often curved at base, thin, rigid, cylindrical, slightly sulcate when dry, violet in lower part, covered with scars of fallen leaves, otherwise pale green, densely leafy (above rather sparsely), corymbiform-subramose or nearly simple; leaves 3–15 mm long, 0.5–1.75 mm wide, nearly erect, linear-lanceolate, 1-nerved, acute at apex, the dry ones with smooth involute margins. Inflorescence very poor, with 1–5 flowers; pedicels twice to four times as long as calyx, elongating in fruit, the lower to 1.8 cm long; flowers medium sized, at first approximate, later rather remote; sepals ca. 3.5 mm long, 2–3 mm wide, broadly ovate or ovate-orbicular, prominently 5-nerved at back, dark (nearly blackish) green, the 3 outer narrowly white-membranous at margin, rounded with short indurate mucro at apex; petals 10–16 mm long, 5–8 mm wide, approximately four times as long as sepals, obovate, rounded at apex, dark blue, tapering to yellow cuneate claw, slightly overlapping at margin, somewhat united towards base but free at base; stamens ca. 5–6 mm long, anthers 1–1.5 mm long, filaments thin; style as long as or slightly longer than stamens and anthers, but much exceeding stamens post-anthesis; capsules ca. 6 mm
106 long, 4.5 mm in diameter, approximately twice as long as calyx, ovoid, acuminate at apex, yellowish or pale brown, with dark green or (nearly) blackish longitudinal stripes between valves; seeds ca. 4.5 mm long, 2 mm wide, narrowly ovate, dark brown, shiny. June. (Plate VI, Figure 1.)

Dry stony mountain slopes. — Centr. Asia: Pam.-Al. (Tadzhik SSR). Endemic. Described from Gissar Range. Type in Leningrad.

Note. This species will probably prove to be closely related to the *Baluchistan L. stocksianum* Boiss. which is known to us only from highly unsatisfactory material.

9. *L. pallescens* Bge. in Ldb. Fl. alt. (1829) 438; Ldb. Fl. Ross. I, 426. — *L. sibiricum* Alef. in Bot. Zeit. 25 (1867) 254, non DC. — Ic.: Ldb. Ic. pl. Ross. alt. illustr. (1830) tab. 142. — Exs.: Kar. et Kir. Pl. song. 1840, No. 160.

Biennial or perennial; root vertical, thin and weak or thick then (nearly) vertical or slightly spreading, becoming woody, yellowish-white; floriferous stems 1–7, 12–50 cm high, erect, straight or slightly curved at base, thin-nish or rather thick, rigid, cylindrical, usually sulcate when dry, with few and scattered traces of fallen leaves, glaucous-pale green, more or less remotely leafy or in lower part densely so, branching from the middle or slightly above into erect-spreading, usually elongate thin flower-bearing branches, rarely with very short non-flowering branches in axils of upper leaves; sterile stems absent or few, very short or medium in length,

remotely or densely leafy; leaves 3–30 mm long, 0.5–3.5 mm wide, spreading or often ascending (to nearly upright), linear or linear-lanceolate and the upper nearly lanceolate, 1–3-nerved, obtuse or the lower often even rounded at apex and the upper usually obtuse but sometimes rather acute, glaucous, thickish, smooth at the often involute margins, with few transparent pits above. Inflorescence few-flowered to generally rather many-flowered, distinctly remote post-anthesis; pedicels several times longer than calyx, elongating in fruit (up to 3.5 cm), usually completely erect, generally thin, disorderly disposed among the short-lanceolate acute leaves, rarely axillary or opposite to leaves; flowers small, 1–1.5(2) cm in diameter; sepals 3–4.5 mm long, glaucous, green, the three outer oblong, acute, inconspicuously white-membranous at margin, in lower part with 3 prominent nerves, the inner broader, oblong-ovate, broadly white-membranous at margin, obtuse, with small mucro, 3–5-nerved; petals more than twice (usually three times) as long as calyx, 7–12 mm wide, narrowly obovate, approximately twice as long as wide, hardly overlapping at margins, rounded or slightly emarginate at apex, entire, pale blue or sometimes white, gradually tapering to yellowish claw; stamens 4–5 mm long (above base of flowers), anthers 0.75 mm long; style usually not exceeding stamens, as long as or shorter than stamens and anthers; capsules ovoid or ovoid-globose, 4.5–6 mm long, 3.5–5 mm in diameter, about twice as long as sepals, pale yellow, often becoming brown; seeds ca. 4 mm long, 1.75–2 mm wide, narrow-ovate, tapering, dark brown, rather dull or slightly shiny. Fl. June–July, Fr. July–September. (Plate VI, Figure 2.)

Dry sandy and stony places, herbaceous slopes, steppes, solonchets, abandoned ploughlands. — W. Siberia: Alt. (Chuya steppe), U. Tob., Irtysh; Centr. Asia: Dzu.-Tarb., Balkh., T. Sh., Pam.-Al. (Alai valley, Pamir). Gen. distr.: Dzu.-Kash. Described from Irtysh (Meier) and Chuya steppe (Bunge). Type (from Irtysh River), paratype in Leningrad.

Note. There is no doubt but that Alefeld was wrong (apparently an oversight) in referring this superior species to the group of dimorphous flax.

Series 2. *Mesostyla* Juz. — Fruiting pedicels more or less curved or even drooping.

10. *L. mesostylum* Juz. nov. spec. in Addenda XIII, 714. — *L. karataviense* Pavl. in Sov. Bot. (1934) No. 1, 25, nom.

Biennial? or perennial; root subvertical, usually slightly spreading, weak or rather robust, becoming somewhat woody, whitish; floriferous stems usually 1–7, 18–60 cm long, generally erect, straight or sometimes slightly curved at base, thin or usually rather thick, rigid, cylindrical, when dry hardly to rather conspicuously sulcate, with few remote traces of fallen leaves in lower part, glaucescent-pale green, usually rather densely leafy (in upper part remotely so), sub-corymbiformly branching above middle or in the upper third, with few erect or spreading straight branches, distinctly elongating in fruit, virgate; leaves 4–30 mm long, 0.5–2.5 mm wide, usually erect to spreading, linear or linear-lanceolate, 1-nerved or in lower part nearly 3-nerved, obtuse at apex, often mucronate or sometimes (mainly the upper) acute, smooth at margin, very often turned up when dry,

glaucous-green. Inflorescence usually more or less many-flowered (6-32); pedicels 4 times as long as calyx, suberect, elongating in fruit but
108 still short, 1-1.8 cm long, somewhat curved or usually horizontally spreading from the arcuately curved base; flowers at first approximate, distinctly remote post anthesis, medium sized, ca. 2.5 cm in diameter; sepals ca. 3-4 mm long, 2-3 mm wide, rather broadly ovate, with 5 prominent nerves at back, rather dark glaucous-green, the three outer narrowly membranous at margin, the two inner broadly white-membranous, the outer obtuse or short-acuminate at apex, the inner with mucronulate or rounded apex; petals ca. 9 mm long, 7 mm wide, about twice as long as sepals, obovate to rather broadly obovate, rounded at apex, blue, tapering to cuneate white or yellowish claw; stamens ca. 0.5 cm long, together with anthers ca. 1 mm long; styles about as long as stamens; capsules ca. 6 mm long and wide, nearly twice as long as calyx, broadly ovoid, rounded or slightly acuminate at apex, straw-yellow or pale brown, often with longitudinal brown lines at grooves; seeds ca. 4 mm long, 2.5 mm wide, ovate, dark brown, somewhat shiny. June.

Dry mountain slopes. — Centr. Asia: T. Sh. (mainly W.), Pam.-Al. (Zeravshan). Endemic. Described from W. T. Sh. Type in Leningrad.

11. *L. violascens* Bge. in Ldb. Fl. alt. I (1829) 439; Ldb. Fl. Ross. I, 426. — *L. sibiricum* var. *parviflora* Ldb. l. c. (1829) 440.

Perennial; root vertical, straight, thick, becoming slightly woody, dirty white; flower-bearing stems few, ca. 40 cm high, erect or slightly ascending at base, straight, rather thin, rigid, cylindrical, when dry somewhat sulcate, with dense to slightly remote traces of fallen leaves in the upper part, sometimes slightly violet, other parts pale green, rather densely (especially below) leafy, branching above into suberect or ascending thin branches; leaves 3.5-4 cm long, 0.5-2 cm wide, the lower shorter, spreading, the upper usually ascending, narrowly linear or filiform-linear but the upper leaves sometimes broader, 1-nerved, acute, smooth at margin, bright green, margins in dry plants always involute. Inflorescence rather many-flowered, loose; pedicels elongate, thin, upright, in fruit curved and laterally spreading; sepals 4.5 mm long, the outer ovate-lanceolate, long-acuminate, smooth at margin and very narrowly membranous, 3-nerved, the inner slightly shorter and broader, acuminate, broadly membranous at margin, all sepals
109 dark- or nearly black-green; petals about twice as long as sepals, obovate, entire, rounded at apex, violet-blue or violet, tapering to white or yellowish cuneate claw; stamens ca. 0.5 cm long; anthers small; style nearly as long as stamens; capsules longer than calyx when ripe, ovoid, acute, somewhat brownish; seeds ca. 4 mm long, ovate, dark brown, slightly shiny. June-July.

Open, usually stony mountain slopes. — W. Siberia: Alt. Endemic. Described from the Katun' and Chuya rivers and also from Ridder district. Type and paratype in Leningrad.

12. *L. baicalense* Juz. nov. sp. in Addenda XIII, 715. — *L. perenne* Ldb. Fl. Ross. I, 426, p. p. — *L. sibiricum* Turcz. Fl. baic.-dahur. I (1842) 246, p. p. non DC. — *L. amurense* Alef. in Bot. Zeit. 25 (1867) 250, p. p. (quoad pl. dauricam).

Perennial; root oblique or vertical, weak to more or less robust, becoming woody, whitish, more or less branching below; caudex 1- or many-headed; flower-bearing stems 1-2, erect or often slightly ascending at base, straight or arcuate below, thin to rather robust, indurate, cylindrical, thinly sulcate when dry, glaucescent or pale green, not too densely leafy, branching in the upper half or fourth into few straight spreading floriferous branches, sterile branches absent or solitary, very short; leaves 0.4-2.5 cm long, 0.3-2.5 mm wide, the lowermost dense, small, squamiform, ovate, pale, the rest linear or the upper lanceolate, straight, spreading, acute, 1-nerved, often with involute margins, glaucous-green; sterile shoots (at base of plant) few, short, weak. Inflorescence not many-flowered to fairly so, 6-30 flowers, branches with short narrowly lanceolate to oblong leaves; pedicels twice to four times as long as calyx, thick, elongating in fruit to 1.5-2.5 cm, usually weak and only slightly curved but distinctly spreading; flowers medium-sized or small, usually not more than 2 cm in diameter; sepals 2.5-4 mm long, 1.5-2 mm wide, the outer ovate, acute, the inner broadly ovate, obtuse, mucronulate, all sepals with 5 prominent veins in lower part, blackish-dark green with glaucous bloom, narrowly white-membranous at margin; petals 8-14 mm long, 5-9 mm wide, two to three times as long as calyx, orbicular-obovate, dark blue, tapering to short pale claw; stamens ca. 5 mm long (from above base of flowers); anthers 1.3 mm long; style as long as or shorter than stamens, free nearly to base; stigmas small; capsules 5-7 mm long, 4-6 mm in diameter, about twice as long as calyx, broadly ovoid to subglobose, yellow or brown, often with longitudinal brown stripes in sulci between valves or entirely dark brown; seeds ca. 4 mm long, 2 mm wide, brown. June-July. (Plate VI, Figure 3.)

Dry meadows, meadows and steppes, stony slopes. — E. Siberia: Dau.
Gen. distr.: N. Mong. Described from Transbaikalia. Type in Leningrad.

13. *L. amurense* Alef. in Bot. Zeit. XXV (1867) 250, s. str. —
L. perenne Kom., Fl. Man'chzh. II, 2 (1904) 664.

Perennial; root usually vertical, more or less robust, becoming woody, whitish; stems few, 20-50 cm high, usually erect, straight, rather robust, indurate, pale green, more or less densely leafy, loosely branching above into few spreading flower-bearing branches as well as long densely leafy sterile ones; leaves up to 2.5 cm long, 3 mm wide, linear or linear-lanceolate, very acute, usually flat, bright green. Inflorescence commonly few-flowered; pedicels thin, distinctly elongating in fruit and horizontally spreading or often drooping; flowers medium-sized to rather large; sepals 5 mm long, ovate or broadly ovate, acute, bright green; petals blue (azure); capsules 6-7 mm long and wide, globose, straw-yellow. In all other parts similar to *L. baicalense* Juz., to which it is closely related. June-July.

Dry sandy meadows and other herbaceous places, gravels. — Far East: Ze.-Bu., Uss. **Gen. distr.:** Jap.-Ch. (Manchuria). Described from Amur River valleys. Cotype in Leningrad.

Group 2. *Heteromorpha* Juz. — Flowers heteromorphic, heterogamous.

Subgroup 1. *Trimorpha* Alef. l. c. (1867) 250 em. — Flowers (in different individuals) trimorphic; long-styled (short-stamened), medium-styled and short-styled (long-stamened).

There is only one species of this group in the USSR which probably belongs (together with some of the Asia Minor species) to the same particular series of the W. European *L. alpinum* L. (we note, however, that *L. anglicum* Mill. — *L. leonii* F., often included in *L. alpinum* L. as varieties or subspecies, apparently belong to the *Homomorpha* group).

14. *L. subbiflorum* Juz. nov. spec. in Addenda XIII, 716. — *L. stocksianum* Grossh., Fl. Kavk. III (1932) 13, non Boiss.

Perennial; multicaulescent caespitose plant; root unknown; stems low, 7.5–11 cm high, erect, slightly curved, thin, cylindrical, becoming lignified at base, pale brown where covered with squamiform leaves, otherwise pale green, sparsely leafy; leaves 4–12 mm long, 0.7–1.5 mm wide, erect to spreading, lanceolate, 1-nerved, with slightly involute margins, acute, glaucous-green. Inflorescences 2(4)-flowered; pedicels twice as long as calyx, 6–10 mm long at anthesis, slightly curved; flowers rather large, 2.5–3 cm in diameter; sepals ca. 5 mm long, ca. 2.5 mm wide, oblong-ovate, acute, narrowly white-membranous at margin or the inner rather broadly so, with 3–5 prominent nerves in lower part, glaucescent-dark green; petals 13–17 mm long, 8–12 mm wide, nearly four times as long as calyx, obovate, gradually tapering to claw, overlapping at margins, apparently lilac-blue; stamens in the long-styled form (like the style in short-styled form) ca. 4 mm long, in medium-styled form ca. 6 mm long (1 mm shorter than style), in short-styled form (like the style in long-styled form) ca. 8 mm long; anthers ca. 1.5 mm long; style thin-filiform, with small capitate stigmas; fruit unknown. Fl. July. (Plate VI, Figure 4.)

Alpine meadows. — Caucasus: S. Transc. (Nakhichevan ASSR), Zangezur Range). Endemic? Described from Dashurly-Dagh. Type in Leningrad.

Subgroup 2. *Dimorpha* Alef. l. c. (1867) 252 em. — Flowers (of different individuals) dimorphic; long-styled (short-stamened) and short-styled (long-stamened).

Series 1. *Perennia* Juz. — Fruiting pedicels erect; fruit usually ovoid.

Subseries 1. *Extraaxillaria* Juz. — High mountain or subarctic taxa with relatively broad (often 3–5-nerved), usually spreading, often bright green leaves and rather large, usually acute sepals.

15. *L. borealis* Juz. nov. spec. in Addenda XIII, 718. — *L. alpinum* Korsch. Tent. Fl. Ross. or. (1898) 84, non Jacq.

Perennial; root usually vertical, rather robust, becoming lignified, pale, spreading, strongly branching, often caespitose; flower-bearing stems 2–6, 10–30(35) cm high, erect, usually straight, rather thin, rigid, cylindrical,

when dry rather distinctly sulcate, pale green, usually simple, often forked, 1- to many-flowered, covered in lower part with small, squamiform, elliptic or spatulate, pale, dense to very dense, long persistent leaves, gradually passing into regular leaves; leaves 0.4–1.5(2) cm long, 0.5–3 mm wide, rather dense, erect or spreading, linear or oblanceolate, widest at the middle or very often above middle, 1-nerved or 3-nerved below, tapering at base, the upper leaves obtuse, uppermost leaves acute, smooth at margin, margins often involute in dry plants, glaucescent or rather bright green. Inflorescence composed of up to 5 flowers; pedicels 0.7–1.5 cm long, in fruit 2 cm long, upright, rather thin; flowers at first approximate, later remote, medium-sized or rather large; sepals all of same length, 1–6 mm, 2–3 mm wide, ovate or narrowly ovate, dark green or often blackish-green, 3–5-nerved below, the three outer acute, not margined or very narrowly white-membranous at margin, the 2 inner obtuse, narrowly white-membranous at margin; petals 1–1.8 cm long, 6–10 mm wide, up to four times as long as sepals, broadly obovate, rounded at apex, apparently lilac-blue, tapering to broad cuneate white or yellowish claw; stamens in long-styled forms 4–5 mm long, in short-styled 6–8 mm long; anthers 1.5–2 mm long; styles 6–8 mm or 4–5 mm long, respectively, filiform; capsules ca. 6–8 mm long, 5–6.5 mm wide, ovoid, tapering at apex, brown; seeds ca. 4 mm long, 2 mm wide, ovate, dark brown, slightly shiny. July. (Plate VII, Figure 1.)

Riverbanks and cliffs. — European part: Dv.-Pech., V.-Kama; W. Siberia: Ob. Endemic. Described from the alpine belt in Konzhakovski Kamen. Type in Leningrad.

16. *L. komarovii* Juz. sp. n. in Addenda XIII, 719. — *L. perenne* Ldb. Fl. Ross. I (1842) 426, p. p.

Perennial; root oblique or vertical, usually robust, branching, becoming lignified, pale; flower-bearing stems few to numerous, 15–60 cm high, straight or slightly curved at base, upright or rarely ascending, thin to rather robust, cylindrical, slightly sulcate when dry, branching in the upper fourth or third into medium-sized or long spreading branches, the lower of which (usually short) often sterile; sterile shoots present, short, with smaller and often more dense leaves; leaves bright green, more or less spreading, not densely disposed, rather large, lanceolate or linear-lanceolate, usually tapering at base, widest at the middle, acute above, usually 3–5-nerved, smooth at margin, flat or (in dry plants) hardly involute; leaves covering the lower part of shoots rather dense, small, ovate-lanceolate or lanceolate, slightly spreading, obtuse or acute, colorless, deciduous. Inflorescence with few or several flowers; pedicels 1.3–2 cm long, rather thin, upright in fruit, 3 cm long; flowers large, averagely ca. 4 cm (to 5) in diameter; sepals 5–7.5 mm long, usually ovate, acute or acuminate, rather bright to dark green; petals large, wide, 1.5 cm wide, almost 4 times longer than calyx, broadly ovate, rounded at apex, blue, becoming lighter at base and tapering to yellowish claw; stamens in long-styled flowers ca. 5–6 mm long, in short-styled ca. 8–10 mm; anthers ca. 1.5 mm long; styles ca. 8–10 and 5–6 mm long, respectively; capsules large, ca. 8 mm long, ovoid, straw-yellow; seeds 4.5 mm long, brown, shiny. June–July. (Plate VII, Figure 2.)

Meadows (mostly in valleys). — E. Siberia: Yenisei?, Ang.-Say., Lena-Kol. Endemic? Described from the Yakut ASSR. Type in Leningrad.

17. *L. altaicum* Ldb. in sched. olim; Fischer ex Steud. Nom. ed. 2, 2 (1841) 51 (nomen nudum). — *L. sibiricum* Bge. in Ldb. Fl. alt. I (1829) 440, non DC. — *L. perenne* Ldb. Fl. Ross. I (1842) 426, p. p. — *L. grandiflorum* Pavl. in sched. non Desf. — *L. perenne* var. *alpicola* M. Pop. in sched.

Perennial; root vertical or oblique, short but robust, strongly branching, becoming lignified, whitish; stems few or often many, sometimes caespitose (when stems of the previous year occur with the present ones); sterile stems present, well developed, leafy hardly denser than flower-bearing stems; floriferous stems 2–15, 15–60 cm high, somewhat arcuately ascending at base, straight or curved, rather thick and robust, cylindrical, sulcate when dry, branching in the upper third or only at apex with nearly erect or ascending branches, the lower of which very often sterile, rather long; basal leaves covering the lower part, nearly imbricate, small, oblong obtuse, colorless appressed to stem, persistent or later deciduous leaving dense scars; leaves 0.5–3 cm long, 1–5 mm wide, spreading to more or less ascending-erect, very often appressed below to stem, rather dense to sparse above, linear-lanceolate or lanceolate, often asymmetrical, widest in the lower part, mostly very acute or acuminate at apex, 1–5 (usually 3) nerved, flat or canaliculate, smooth at margin, when dry very often margins involute, bright green. Inflorescence impoverished, (1)3–10-flowered, with some branches bearing up to 5 flowers; bracts few, broadly lanceolate, long-acuminate; pedicels 0.5–1.5 cm long, in fruit 2 cm, erect, straight or hardly curved, rather thin to thick; flowers usually axillary, at first approximate, later rather remote, 3–3.5 cm in diameter; sepals 114 4.5–7 mm long, 1.5–3.5 mm wide, the outer ovate-lanceolate or ovate, acute, narrowly white-membranous at margin, inner sepals elliptic, narrowly to broadly-white-membranous at margin, obtuse or rounded and short-mucronate at apex, bright or rather dark green, 5-nerved at base; petals 1.4–2.2 cm long, 7–10 mm wide, nearly 4 times longer than sepals, obovate, twice as long as wide, orbicular or obtuse at apex, lilac-blue, becoming paler towards base and gradually tapering to yellowish claw, hardly overlapping at margins; stamens of short-styled flowers 7–8 mm long, slightly exerted from calyx; anthers ca. 1.5 mm long; styles 7–7.5 and 4.5–6 mm long, respectively; capsules 7–8 mm long, 5–6 mm wide, almost twice as long as calyx, ovoid, tapering above or subglobose, nearly straw colored or brown above; seeds ca. 4.5 mm long, 2 mm wide, cuneate-ovate, brown, dull or slightly shiny. Fl. first half of June to first half of August.

Alpine, subalpine and mountainous forest meadows. — W. Siberia: Alt.; Centr. Asia: Dzu.-Tarb., T. Sh. Gen. distr.: Mongolian Altai, Dzu.-Kash. Described from Altai (Ledebour's chirotype from Ridder). Type and paratype in Leningrad.

18. *L. atricalyx* Juz. nov. spec. in Addenda XIII, 719.

Perennial; resembling *L. altaicum* Ldb., but stems usually not more than 40 cm high, with very short sterile branches or without; leaves glaucescent or glaucous-green, the lower obtuse or often even rounded at

apex. Flowers smaller than in *L. altaicum*, 2.5–3 cm in diameter; sepals blackish-green; petals 1.5–2 cm long, 1–1.3 cm wide, nearly twice as long as wide, with overlapping margins, very dark blue; capsules ca. 6–7 mm long, almost completely hidden by sepals to nearly twice as long. In all other parts like *A. altaicum*. July.

19. *L. turcomanicum* Juz. nov. spec. in Addenda XIII, 720.

Perennial; similar to *L. altaicum* Ldb. in habit; root vertical, becoming lignified; stems 20–35 cm high, numerous, thin, slightly branching; leaves not too dense, spreading, linear-lanceolate, acutely 3-nerved, glaucescent, 2 cm long. Flowers ca. 3 cm in diameter; pedicels erect, distinctly jointed beneath flowers; sepals ca. 5 mm long, acute or narrowly
115 acuminate, dark green, white-membranous at margin; stamens ca. 5 mm (in long-styled forms) or ca. 8 mm (in short-styled forms) long; styles ca. 8 or 5 mm long, respectively; capsules not known. June.

Habitat unknown. — Centr. Asia: Mtn. Turkm. Endemic? Described from Masinev (from Androsov collections). Type in Leningrad.

Note. Little is known about this species, which resembles *L. altaicum* only in habit; we have included it in the group *Extraaxillaria*. In some of the scrutinized specimens the flowers fell off without fruits, as described for the enigmatic Iranian *L. sterile* Stapf. Comparison of the Russian plants with *L. sterile* was impossible because of the lack of material on the latter; judging by its description it is distinctly different from *L. turcomanicum*.

20. *L. extraaxillare* Kit. in Roch. Pl. Banat. (1828) 26, nom. solum; Kit. in Linnaea, XXXII (1863) 573; Sag. u. Scheid. Fl. centr. Karp. II (1891) 103; Alef. Bot. Zeit. XXV, 254. — *L. alpinum* β . *elatus* Wahlenb. Fl. Carp. (1814) 91, sec. Uechtritz in Oest. Bot. Zeit. XVI (1866) 318. — *L. perenne* var. *carpaticum* Uechtritz mss. ex Alef. l. c. (1867) 254. — Ic.: Hayek, Pflanzend. Oesterr.-Ung. 1 (1915) 401. — Exs.: Rehm. et Wol. Fl. polon. exs. No. 25; Fl. exs. austro-hung. No. 865.

Perennial; root vertical, robust, pale; stems few, 16–30 cm high (and higher), erect or slightly ascending, nearly straight from the slightly curved base, thin, subcylindrical, smooth, remotely to rather densely leafy, always branching in upper part, lower branches (lateral) sterile, the upper 2–3 flower-bearing, usually extra-axillary; leaves numerous, scattered, nearly horizontally spreading, the median leaves 2–3.5 cm long, ca. 2.5 mm wide (and wider), linear-lanceolate, rather long- and narrow-acuminate, distinctly 3-nerved below, thin, bright green. Inflorescence impoverished, loose; pedicels 2.5 cm long, always erect in fruit; between the flowers bracts (i. e., extra-axillary), 3–4 cm in diameter; sepals ca. 6 mm long, ovate-lanceolate, acute, the inner ovate, acuminate, white-membranous at margin, 3-nerved; petals three to four times as long as sepals, obovate, slightly crenate at apex, pale and lilac-blue, tapering to yellowish claw, overlapping at margins; stamens in long-styled forms shorter than sepals, in short-styled distinctly longer; capsules ca. 8 mm long, ovoid or ovoid-globose, straw-yellow; ripe seeds black-gray. July.

Alpine and subalpine mountainous belt (above elfin woodland). — European part: U.Dns. (Carpathians, Bukovina). Gen. distr.: Centr. Eur. (Banat), Bal.-As. Min. (Bosnia, Chernogoriya). Described from "e Scepusio," paratype from Pop-Ivan. Type probably in Budapest.

- 116 Subseries 2. Eu-perennia Juz. — Steppe forms with leaves narrower, more or less spreading, glaucous-green, 1–3-nerved; sepals smaller, obtuse.

21. *L. perenne* L. Sp. pl. ed. 1 (1753) 277, p. p.; Mill. Gard. Dict. ed. 8 (1768) No. 6; Ldb. Fl. Ross. I, 426, p. p. — *L. perenne* subsp. α . *genuinum* Shmal'g., Fl. I, 184. —? *L. perenne* α . *sibiricum* Schiede in Linnaea, I (1826) 71, p. p. — *L. perenne euperenne* Hermann, Fl. Deutschl. Fennosc. (1912) 301. — *L. sibiricum* DC. Prodr. I (1824) 427, s. str.; Spreng. Syst. veg. I (1825) 963. — *L. Beauharnaisianum* Spadoni, Nuova spec. di Lino orig. di Siberia (1808) tab. I. — *L. bavaricum* Schultz in Flora, XXV, 2 (1839) 643. — *L. Darmstadinum* Alef. in Bot. Zeit. XXV (1867) 251. — *Adenolinum perenne* Rchb. Ic. VI (1844) 65. — Ic.: Rchb. l. c. (1844) tab. CCCXXXVI, f. 5159; Spadono, l. c.

- Perennial; root vertical or oblique, robust, usually strongly branching, rarely nearly simple, becoming woody, pale yellow; flower-bearing stems few, 20–80 cm high, straight or slightly curved at base, erect or ascending, thin to usually more or less robust, indurate, cylindrical, when dry faintly sulcate, pale green with yellow tinge, simple or in the upper half to fourth corymbiformly branching, lower branches very often sterile, the lowermost part with few remote large traces of fallen leaves, otherwise rather densely leafy; sterile stems rather densely leafy, with erect or spreading linear leaves; leaves of flower-bearing shoots 0.4–5 cm long, 0.5–3 mm wide, spreading to erect, linear or linear-lanceolate, the lower acute, the upper long-acuminate, 1–(3) nerved, margins slightly thin-denticulate-scabrous flat (or in the upper leaves), involute, glaucescent to usually pure-green. Inflorescence composed of rather many-flowered cymes, their leaves short but usually rather broadly lanceolate; pedicels erect, short, twice to three times as long as sepals, much elongating post-anthesis and reaching 1.5–2.5 cm, thin, straight or hardly recurved in fruit; flowers small or medium-sized, 2–3 cm in diameter; sepals medium-sized, 3.5–4.5(5) mm long, the outer ovate-elliptic, obtuse or acuminate, with or without narrow white-membranous margin, inner sepals broadly ovate, rounded at apex, broadly white-membranous at margin, shortly mucronulate, slightly longer and distinctly wider than the outer sepals, dorsally with 3–5 prominent nerves below, glaucescent or pale green, darker in fruit (sometimes reddening); petals 1–2 cm long, 0.8–1.5 cm wide, obovate or broadly obovate, almost four times as long as sepals, cuneately tapering at base, obtuse or orbicular above, pale blue, rarely white, with yellowish claw, overlapping at margins; stamens in long-styled forms (as styles in short-styled forms) 4–6 mm long, only slightly longer than sepals, stamens in short-styled forms (as styles in long-styled forms) 6.5–9 mm long, usually bluish above; anthers 1.15 mm long; stigma ovate or obovate, often cuneately tapering; capsules 5–7 mm long, 4–6 mm wide, usually broadly ovoid, about twice as

long as calyx, shortly mucronate at apex and with hairy septa; seeds ca. 3.5–4 mm long, obliquely oblong-ovate, flattened, dark brown, shiny. June–July. (Plate VII, Figure 4.)

Steppes, steppical and meadowy slopes, chalk outcrops. — European part: M.Dnp., V.-Don, Transv., V.-Kama, U.Dns., Bes., Bl., L.Don; W.Siberia: U.Tob., Irt., Alt. **Gen. distr.:** Centr.Eur., Bal.-As.Min. Described from W.Siberia. Type in London.

Economic importance. *L. perenne* is sometimes grown as an ornamental plant. In his "Von perennierenden Sibirischen Leine" (Halle, 1754), D.G.Schreber pointed out the possibility of using this species as a textile plant, but the author's hopes for a Siberian flax were apparently not fulfilled. In this context, other species of the section should be carefully studied.

Note. A rather variable species which is in need of more study. We could not discriminate the two W.European "species" distinguished by Alefeld from the S.Russian (and Siberian) forms of *L. perenne* as well as from each other.

22. *L. brevisepalum* Juz. nov. spec. in Addenda XIII, 720. — *L. perenne* Ldb. Fl. Ross. I (1842) 426, p. p. — *L. sibiricum* Turcz. Fl. baic.-dahur. I (1842) 246, p. p.

Perennial; root vertical, often thin, very flexuose, branching, whitish; stems 15–60 cm high, usually few, often straight and completely upright; sturdy, usually branching only in upper one-fourth to one-sixth, branches often spreading; sterile shoots rarely present, usually weak, not long; leaves short, 0.5–2.5 cm long, ascending, usually strict, glaucescent or gray-green, obtuse or the upper (rather) acute, 1–3-nerved. Flowers often few, 2–3 cm in diameter, short-pedicel, pedicels in fruit usually shorter than 2 cm long; sepals short, 3–4 mm long, broadly ovate to suborbicular, the outer obtuse, the inner rounded at apex, both inner and outer short-mucronate at tip, more or less broadly white-membranous at margin; petals 1.3–1.8 cm long, 7–13 mm wide, broadly obovate, obtuse at apex, blue with yellowish claw; stamens of long-styled and style of short-styled forms 5–6.5 mm long, distinctly longer than calyx, stamens of short-styled and style of long-styled forms ca. 8 mm long; anthers ca. 1.5 mm long, short-ovate; capsules 3–6 mm long, 4–5 mm in diameter, broadly ovoid to flattened-globose, usually more than twice as long as calyx, brown when ripe; seeds 3.5–4 mm long, elliptic, nearly black-brown, shiny. Otherwise similar to *L. perenne* L. June–July.

Steppes, steppical slopes, dry meadows, sandy places along riverbanks. — E.Siberia: Yenisei (S.), Ang.-Say. (Irkutsk). Endemic. Described from Yenisei region. Type in Leningrad.

Subseries 3. *Euxina* Juz. — Mountain forms with narrow, 1-nerved, very dense, suberect leaves often subappressed to stem, and acute or obtuse sepals.

23. *L. euxinum* Juz. nov. spec. in Addenda XIII, 721. — *L. squamulosum* DC. Prodr. I (1824) 426, p. p.; Stev. Verz. Taur. Halbins. Pflz. (1859) 91 et auct. plur. fl. Taur. (et Cauc.) p. p. non Rudolphi. — *L. austriacum* γ. *squamulosum* Boiss. Fl. or. I (1867) 864, p. p. — *L. perenne* subsp. γ. *squamulosum* Shmal'g., Fl. I (1895) 184.

Perennial; root vertical, flexuose, weak to rather robust, becoming woody; flower-bearing stems few or often many, (1)2–18, 12–36 cm long, slightly curved at base, otherwise upright, rather thin, rigid, cylindrical, when dry more or less sulcate, lilac or brown in the lower part, otherwise pale greenish, exceptionally densely leafy below where covered with much adjacent traces of fallen leaves, densely leafy elsewhere, corymbiformly few-branched at apex; leaves 0.3–1.2 cm long, 0.1–1 mm wide, erect, appressed to stem or ascending-erect, narrowly linear or nearly filiform, 1-nerved, often with involute margins, acute at apex, glaucous-green. Inflorescence few- to many-flowered, with flowers approximate, remote post-anthesis; pedicels nearly twice as long as calyx, filiform, short in fruit, the lowermost 1 cm long, erect or ascending, straight or slightly recurved; flowers ca. 2 cm in diameter; sepals 2.5–4 mm long, 2.3 mm wide, the outer three broadly ovate, acuminate or obtuse at apex, the two inner suborbicular, obtuse or mucronulate, dorsally with 3 prominent nerves, glaucous-greenish, all (the inner more broadly) white-membranous at margin; petals ca. 12 mm long, 7 mm wide, four to six times as long as sepals, broadly obovate, blue, gradually tapering to yellow cuneate claw; 119 stamens of long-styled forms (as styles of short-styled forms) ca. 3 mm long, stamens of short-styled forms (as styles of long-styled forms) ca. 6 mm long; anthers ca. 1 mm long; styles filiform, with small capitate stigmas; capsules small, 4.5–6 mm long, 4–5 mm in diameter, two to three times as long as calyx, ovoid, slightly tapering and acuminate at apex, brownish; seeds ca. 3.5 mm long, 2 mm wide, flattened-ovate, dark brown, shiny. June.

Open dry slopes, stony places. — European part: Crim.; Caucasus: W. Transc. (Novorossiisk). Endemic. Described from near Sevastopol' district (also Balaklava, Feodosiya and Cape Tarkhankut). Type (and paratype) in Leningrad.

Note. This endemic Crimean-Novorossiisk form, together with some other forms, has been referred up to now to "*L. squamulosum* Rud." in accordance with de Candolle's understanding of this species. *L. squamulosum* Rud., to which de Candolle attributed some characters typical of *L. euxinum*, occurs in the Crimea and Don area (due to which fact he confused the Russian taxon with some other). Steven also regarded *L. squamulosum* Rud. as a Crimean species, but what he really accepted was without doubt *L. euxinum* (confusing it as well with another form, of which more is mentioned below). *L. squamulosum* Rud. was originally described without indicating its "locus natalis," and in the description not one of the characters so typical of *L. euxinum* was mentioned. Some of the most prominent W. European botanists (Reichenbach, Alefeld, Velenovsky, Ascherson, Graebner, Hegi and others) stubbornly perceived in *L. squamulosum* Rud. a plant (or plants, to be more precise) closely related to it, namely *L. austriacum* L., as if it were one (or several) of the races of this polymorphic species. Apparently even Ledebour shared this view. The only more or less reliable specimen of the original *L. squamulosum* Rud. which we have seen is from the Ledebour herbarium and bears a label in his handwriting. This specimen unquestionably belongs to *L. austriacum* L. *L. euxinum* obviously has very little in common with *L. austriacum*; consequently

we have proposed a new name for this taxon. It should be mentioned that besides *L. euxinum* there grow in the Crimea at least two more forms which have never been separated from it and which have also been presented as *L. squamulosum* "Rud." (see the following species and also the note to *L. austriacum*). Eventually, retaining this name for one of these Crimean species would be highly arbitrary.

In the Caucasus, *L. euxinum* grows apparently only in the Novorossiisk district. All other reports on the distribution of *L. squamulosum* in the Caucasus pertain apparently to forms of *L. austriacum* (s. l.) or some other as yet undescribed population.

120 24. *L. marschallianum* Juz. nov. spec. in Addenda XIII, 721. —

L. alpinum Pall. in sched. non *L.* — *L. austriacum* β . M.B. Fl. taur.-cauc. I (1808) 255. — *L. squamulosum* Stev. l. c. et auct. fl. taur. p. p. non Rud.; Ldb. Fl. Ross. I, 426, pro min. p.

Perennial; root often oblique, usually thick and robust, becoming woody; flower-bearing stems many, 8–30(50) cm high, prostrate or decumbent at base, otherwise nearly erect, straight or sometimes slightly flexuose, thick, rigid, cylindrical, pale? in lower part, pale green in other parts, like sterile stems densely covered with long persistent, adjacent, nearly imbricated leaves, corymbiformly branching at apex; leaves 2–10(20) mm long, 0.3–1(2) mm wide, erect or nearly so, linear or the upper broadening in lower part and linear-lanceolate, 1-nerved, usually involute at margin, acute or very acute, bright green. Inflorescence few- or many-flowered (up to 12); pedicels hardly or twice as long as calyx, thick, amply elongating in fruit, up to 2 cm long, erect, straight, or somewhat curved; flowers approximate, ca. 2.5 cm in diameter; sepals rather large, 5–6 mm long, 2.5–4.5 mm wide, the three outer ovate-elliptic, acuminate at apex, narrowly white-membranous at margin, the two inner broadly ovate or obovate, rounded and mucronate at apex, broadly white-membranous at margin, 3–5-nerves markedly protruding below, glaucescent-dark-green; petals ca. 1.5 cm long, 1 cm wide, approximately twice as long as sepals, broadly, obovate, rounded at apex, blue, gradually tapering below to yellowish claw; stamens in long-styled forms (like styles in short-styled forms) ca. 4.5 mm long, ca. 7 mm long in short-styled forms; anthers ca. 1.5 mm long; styles filiform, with short ellipsoidal stigmas; capsules ca. 8 mm long, 6 mm in diameter, slightly to twice as long as calyx, ovoid, tapering at apex and acuminate, becoming brown; seeds ca. 4.5 mm long, 2.5 mm wide, flattened, obliquely ovate-elliptic, brown, shiny. May–July. (Plate VII, Figure 3.)

Stony slopes, mountainous pastures and meadows. — European part: Crim. (Yaila). Endemic. Described from the stony talus Aunda north of Gurzuf and from Roman-Kosh. Type in Leningrad.

123 Note. This is apparently a hereditarily constant form (race) vicarious to the foothill *L. euxinum* Juz. in the yailas of the Crimea.

Series 2. *Austriaca* Juz. — Fruiting pedicels more or less distinctly arcuately curved, usually drooping; capsules flattened-globose.

25. *L. austriacum* L. Spec. pl. ed. 1 (1753) 278; Ldb. Fl. Ross. I, 427. — *L. perenne* Ldb. l. c. 426, p. p. — *L. perenne* β . *austriacum* Schiede in Linnaea, I (1826) 71. — *L. perenne* subsp. β .

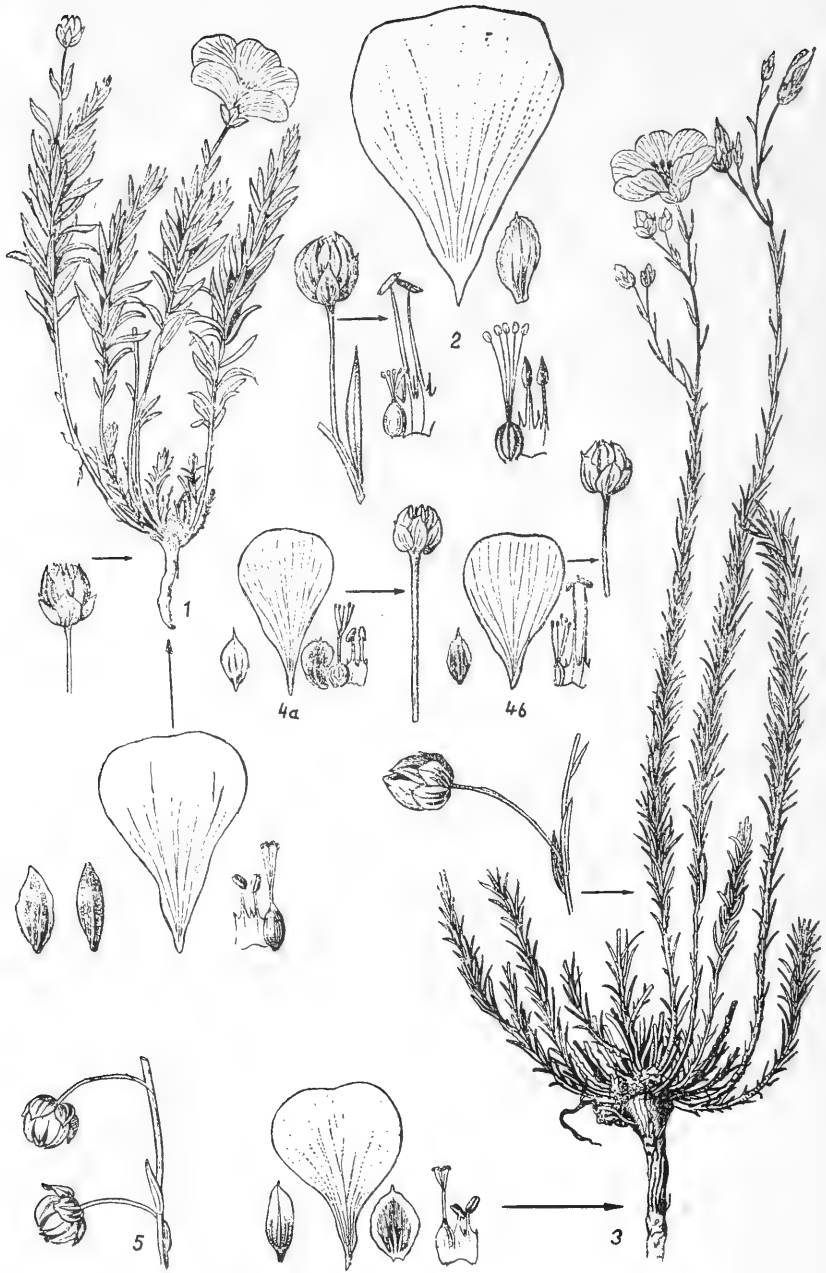


PLATE VII. 1 - *Linum boreale* Juz., habit, details of flower of long-styled form, capsule; 2 - *L. komarovii* Juz., details of flowers of short- and long-styled forms: sepals, petals, stamens, pistils, capsule; 3 - *L. marschallianum* Juz., habit, details of flower of long-styled form, capsule; 4 - *L. perenne* L., details of flower of long-styled (4a) and short-styled (4b) forms and capsule; 5 - *L. austriacum* L., capsules.

austriacum Shmal'g., Fl. I (1895) 184.— *Adenolinum austriacum* Rchb. Handb. Pflanzensyst. (1837) 307; Ic. VI (1844) 66.— *L. austriacum* α . pratense Neilr. Fl. Nieder-Oesterr. (1859) 865.—? *L. squamulosum* Rudolphi in Willd. Enum. (1809) 339; Ldb. Fl. Ross. I, 426, pro max. p.; Simonk. Enum. Fl. Transs. (1887) 152; Alef. in Bot. Zeit. 25 Jahrg. No. 32 (1867) 255.— *L. austriacum* γ . *squamulosum* Boiss. Fl. or. I (1867) 864, p. p.— *Adenolinum squamulosum* Rchb. VI (1844) 66.— *L. kirgisicum* Alef. l. c. 255.— Ic.: Rchb. l. c. (1844) tab. CCCXXXVIII, f. 5156 (et 5156, b — "*Adenolinum squamulosum*"); Hegi, III. Fl. V, 1, tab. 175, f. 2.— Exs.: Dörf. Herb. Norm. No. 4508; Fl. exs. reip. Bohem.-Slov. No. 239; Fl. čechosl. exs. No. 50.

Perennial; root horizontal, thin or rather robust, strongly branching; flower-bearing stems single to usually many, straight or rarely arcuate at base, erect or ascending, (10)15–60 cm high, cylindrical, more or less branching in the upper third to fifth branches short, inclined at an acute angle, abundantly leafy; sterile shoots present, erect, usually short; leaves usually straight, ascending or rarely suberect or horizontally spreading, ca. 1 cm long, 0.5–1 cm wide, linear or linear-lanceolate, sometimes thick, smooth at margin, the lower leaves obtuse, the median and upper acute or acuminate, usually 1-nerved, glaucous or gray-green. Inflorescence usually many-flowered; pedicels rather long, longer than sepals, erect at first, later more or less arcuately curved, finally completely drooping, 2–3 cm long; sepals 4–6 mm long, 2.25–3.5 mm wide, the outer three ovate-lanceolate, acute, narrowly membranous at margin, in lower part prominently 3-nerved, inner petals ovate or broadly so, acute or obtuse at apex, mucronate, more or less broadly membranous at margin, prominently 3–(5) nerved below; petals 10–17 mm long, triangular-obovate, obtuse at apex, sky blue with darker stripes, very rarely white, tapering at base to yellowish claw, overlapping at margins; stamens of long-styled form (and styles of short-styled forms) ca. 4 mm long, stamens of short-styled form (and styles of long-styled forms) ca. 7 mm long from base of flowers; capsules globose-ovoid, globose or flattened-globose, ca. 4–5 mm long and wide, obtuse at apex, brown-yellow; seeds ovate-oblong, flattened, ca. 2.5–3.6 mm long, pale brown, slightly shiny. Fl. June–July, Fr. July–August. (Plate VII, Figure 5.)

Steppes, dry hills and mountain slopes, chalks and other outcrops.— European part: M. Dnp., V.-Don, Transv., Bl., L. Don, L. V., Crim.; W. Siberia: U. Tob., Irt.; Caucasus: Cisc., Dag., E. and S. Transc. **Gen. distr.:** Centr. Eur., Med., Bal.-As. Min., Iran. Described from Lower Austria. Type in London.

Note. *L. austriacum*, as accepted here, is not homogeneous throughout its distribution area and may be subdivided into groups of separate races. However, the characters distinguishing these races are so minute and variable that more study of these populations in nature and experiments in cultivation are required for reliable diagnoses. Alefeld (l. c. p. 255) assumed that the original *L. austriacum* L. would not be found beyond the borders of Austria, thus treating the S. Russian form as *L. squamulosum* Rud. Moreover, he described a species from W. Siberia distinctly referring to the group of *L. austriacum* s. l.

and named it "*L. kirgisicum* Alef." (his type was collected in 1771 by Falk's companion Bardenos along the Tobol River, and is now preserved in Munich). Finally, Alefeld referred the Caucasian plants to *L. carnosulum* Boiss., described from Asia Minor (Lydia). After extensive examination of more material we prefer to reject Alefeld's treatment of the given group as not reflecting the real relationships. In any event there is no possibility of distinguishing within the Russian flora the recorded types as characterized by Alefeld, and the whole question on the racial composition of *L. austriacum* s. l. in general requires re-examination.

Besides, there is a unique form growing near Simferopol and Karasubazar (in the Crimea) on limestone and chalk outcrops which in our view is related to the series *Austriaca*, but in habit (in particular, the character and arrangement of leaves) is somewhat reminiscent of *L. euxinum* Juz. Caucasian botanists very often present it and *L. euxinum* as *L. squamulosum* Rud. (both plants were first combined under this name by Steven, who wrote that in *L. squamulosum* the fruiting pedicels varied in direction, sometimes erect, other times drooping). In splitting *L. austriacum* s. l. into individual races, the Simferopol population apparently will have to be distinguished as a separate species, for which we propose the name "*L. stevenianum* Juz." (for its characteristics, see note to *L. euxinum* L. in Addenda). It is not ruled out that one day it might be proved to be the original *L. squamulosum* s. str.

- 125 Section 3. *STELLEROLINUM* Juz. nov. sect. — Flowers relatively small, rather long-pediceled; sepals with few glands at margins, indurate-mucronate at apex; petals free, blue (rarely white); stigmas capitate. Annual, strongly branching herbs, with numerous alternate linear leaves without stipular glands.

26. *L. stelleroides* Planch. in Lond. Journ. of Bot. VII (1848) 178. — *L. apiculatum* Franch. et Roch. in herb. — *L. karoï* Freyn in Oesterr. Bot. Zeitschr. (1902) 15.

Annual; high plant, glabrous in all parts; root short, simple, somewhat fibrous; stems erect or ascending, cylindrical, somewhat woody at base and covered with traces of fallen leaves, 30–70 cm high, much branching in upper part; leaves many, dense, 2–4 cm long, 1–2 mm wide, sessile, ascending, linear or linear-lanceolate, acute, flat, 1–3-nerved, glaucescent, glabrous. Inflorescence paniculate, strongly branching, branches many, virgate, ascending, straight, covered with small leaves 0.5–1.5 cm long and 0.5–1 mm wide; pedicels three to four times as long as calyx; flowers not more than 1 cm in diameter, generally many but separate; sepals broad, orbicular or ovate, green, very narrowly marginate, with obscure nerves, ending in short stiff mucro, beset at margins with few black glands, inner sepals with single gland at apex; petals blue or pale violet (very rarely white); stamens as long as styles; stigmas capitate, obovate; capsules slightly longer to twice as long as calyx, ovoid or flattened-globose, acuminate, terminating in well developed mucro; seeds flattened, ovate, brown, shiny. June–August.

Herbaceous places in open, stony and clayey slopes, roadsides. — Far East: Ze.-Bu. (rarely), Uss. Gen. distr.: Jap.-Ch. Described from China. Type in London.

Section 4. *DICHROLINUM* Planch. in Lond. Journ. of Bot. VI (1847) 597. — Flowers short-pedicelled; sepals glandular at margin; petals free, pink-white, with darker claw, stigmas capitate. Semishrubs (or small shrubs), with alternate linear or setiform dense leaves, without stipular glands.

27. *L. tenuifolium* L. Sp. pl. ed. 1 (1753) 278; Ldb. Fl. Ross, I, 424; Shmal'g., Fl. I, 183. — *L. rubens* Pall. in sched. — *L. cilicicum* Fenzl in Tschihatch. As. Min. Bot. I (1860) 141. — Ic.: Rchb. Ic. Fl. Germ. VI (1844) tab. 328, f. 5165; Baillon, Ic. Fl. Fr. II (1885–1894) tab. 166. — Exs.: Rchb. Fl. exs. Germ. No. 1498; Fl. Gall. et Germ. exs. No. 430; Fl. exs. Reip. Bohem.-Slov. No. 338; Callier, It. taur. III a 1900, No. 559.

126 Perennial; root rather thick, vertical, slightly branching, woody, yellowish; caudex more or less strongly branching; stems few or many, 15–50 (100) cm high, woody at base, cylindrical, finely sulcate, sparsely short-hairy, branching in the upper half to fourth into thin ascending branches; sterile shoots present low; leaves alternate, dense in the lower part of stem, loose above, sessile, erect or ascending, linear to narrowly linear-lanceolate, rigid, acute, the upper shorter and acuminate, all leaves 1-nerved, scabrous and uprolled at margin, otherwise glabrous, glaucous-green, shiny. Inflorescence loose, slightly leafy, composed of paniculately arranged cymes, relatively few- (usually 9–35) flowered; pedicels short, thin, glabrous, elongating in fruit; flowers homogenous; sepals 5–8 mm long, lanceolate to ovate-lanceolate, acuminate, glaucous-green, paler at base, dorsally keeled with strongly protruding midrib, with two inconspicuous lateral nerves near margin, glandular-ciliate at margin, with stalked or subsessile yellowish glands, persistent in fruit, the three outer sepals (longer) much longer than capsule, the two inner (shorter) approximately as long; petals free, 10–15 mm long, about twice as long as calyx, obovate, mucronulate at apex, cuneately tapering to short claw, pink or pale lilac, rarely white with yellowish claw; stamens 6–7 mm long; filaments dilated, usually somewhat connate at the sparingly pubescent base; anthers narrow, 1.8 mm long; styles very thin, ca. 6 mm long; stigmas capitate; capsules erect, 3–4 mm long and wide, ovoid or globose, acuminate at apex; false septa pubescent; seeds ca. 2 mm long, obliquely elliptic, flattened, smooth, pale brown, shiny. Fl. May–July, Fr. June–September.

Steppes, steppe slopes, dry hills, pine forests, stony slopes and outcrops, cliffs, taluses. — European part: M. Dnp., Bl., Crim.; Caucasus: Cisc., Dag., E., W. and S. Transc. Gen. distr.: Atl. and Centr. Eur., Med., Bal.-As. Min., N. Afr. Described from France (and Switzerland). Type in London.

Note. It is possible that this Mediterranean taxon has not been completely studied in its extensive, mostly interrupted distribution area and that its racial composition requires further investigation. The Crimean

- 127 plants (to which the cited synonym by Pallas is referred) are easily distinguished from the Ukrainian ones by the slightly larger and longer stalked glands at margins of sepals; this character is apparently inconsistent and not always displayed.

Section 5. *CATHARTOLINUM* Rchb. Handb. (1837) 306, pro gen. exp.; Planch. in Lond. Journ. of Bot. VI (1897) 598. — Flowers short-pedicelled; sepals glandular at margin; petals free, white; stigmas capitate. Leaves opposite, elliptic, without stipular glands. Annuals or biennials.

28. *L. catharticum* L. Sp. pl. ed. 1 (1753) 281; Ldb. Fl. Ross. I, 425; Shmal'g., Fl. I, 181. — *L. diversifolium* Gilib. Fl. Lithuan. V (1781) 143. — *Cathartolinum pratense* Rchb. Ic. Fl. Germ. VI (1844) 61. — *L. catharticum* f. *annuum* et f. *bienne* Betner in Vestn. Russk. Fl. III (1917) 22. — *L. suecicum* Murbeck sec. Hayek, in Mag. Bot. Lap. V (1906) 278. — *L. catharticum* subsp. *B. suecicum* Hayek, Fl. Steierm. I (1909) 621. — Ic.: Sowerby et Sm. Engl. Bot. VI (1797) 382; Rchb. l. c. (1844) tab. 325, f. 5153; Bonnier, Fl. Compl. Fr. Suisse et Belge, II (1912) tab. 93. — Exs.: Pl. Finl. exs. No. 283, a, b (f. *annua*), No. 790 (f. *annua*), 791 (f. *biennis* = *L. suecicum* Murb.); Fl. polon. exs. No. 26 (f. *annua*); Meinsh. H. Fl. Ingr. No. 129 (f. *biennis*); G.R.F. No. 14 (f. *biennis*).

Annual, rarely biennial (and even perennial); root thin, vertical, whitish; stems 5–30 cm high, erect or ascending, simple (branching only in inflorescence) or branching from base, thin, glabrous, usually sparsely leafy; leaves opposite (the upper often alternate), sessile, entire, scabrous at margin (especially in lower part) with short, recurved, ciliate hairs (bristles), distinctly 1-nerved, lower leaves oblong-obovate, acute to nearly obtuse, upper leaves lanceolate, acute. Inflorescence loose, with furcately spreading branches, sparsely leafy; pedicels rather long, thin, glabrous, drooping before anthesis; sepals elliptic, 2–2.5(3) mm long, slightly acuminate at apex, glandular-ciliate at the upper half; petals oblong-obovate, cuneate, (3)4–5(6) mm long, white, yellow at base; stamens ca. 2 mm long, connate at base, with denticulate appendages between filaments; ovary with 5 capitate stigmas on thin falling styles; capsules erect, globose, 2–3 mm long, with walls long-hairy inside; seeds 1–1.5 mm long, elliptic, flattened, smooth, pale brown. (May)June–August(September).

Dry, also moist and wet meadows, shrubby formations, forest clearings and other open or shady herbaceous places, floodplains, streams on moist cliffs, fields, etc. — European part: Kar.-Lap., Dv.-Pech., Lad.-Ilm., 128 V.-Kama, V.-Don, U. Dnp., M. Dnp., Bl., Crim.; Caucasus: Cisc., Dag., E. and W. Transc. Gen. distr.: nearly all Eur., As.-Min., N. Afr., Iran. Described from C. Europe. Type in London.

Economic importance. In earlier times the plant was used in medicine as a cathartic.

Note. The biennial (and perennial) form of this plant occurs very often in the USSR. It might be separated from the original (annual) *L. catharticum* after more adequate investigation of the conditions of its growth

and distribution. Particular in this respect is the synonym *L. suecicum* Murb. (and apparently also *L. catharticum* β . *subalpinum* Hausskn. Mitt. Thür. Bot. Ver. N. F. VI (1894) 22). The relation between *L. suecicum* and *L. catharticum* s. str. is possibly similar to the relation between *Gentiana axillaris* F. W. Schmidt and *G. uliginosa* Willd., which is now usually accepted as a separate species. See also: R. G. Betner. *Lugovye formy l'na slabitel'nogo* — *L. catharticum* i ikh veroyatnoe proiskhozhdenie (Meadow Forms of *L. catharticum* L. and their Probable Derivation), Vestn. Russk. Flory, V. III, No. 1, 1917, pp. 17–35. In this work it is established that the biennial *L. catharticum* (i. e., *L. suecicum*) is common in places that are not farmed.

Section 6. LINOPSIS (Rchb. Handb. (1837) 306, pro gen.) Planch. in Lond. Journ. of Bot. VI (1847) 598. — Flowers yellow, short-pediceled; sepals glandular-hairy at margins; petals free; stigmas capitate. Leaves alternate, without stipular glands or often glandular. Annuals (in the USSR) or perennial herbs or semishrubs.

29. *L. corymbulosum* Rchb. Fl. Germ. excurs. (1832) 834; Ldb. Fl. Ross. I, 422; Boiss. Fl. or. I, 852. — *L. liburnicum* auct. plur. vix autem Scop. Fl. Carn. ed. 2, I (1772) 230. — *L. aureum* DC. Prodr. I (1824) 423, excl. syn. Scop. non W. K. — *L. strictum* auct. plur. Fl. Ross. non L. — *L. strictum* β . *corymbulosum* Planch. in Lond. Journ. of Bot. VII (1848) 476. — *L. gallicum* auct. plur. fl. Ross. non L.; Ldb. Fl. Ross. I, 422, p. p.; Shmal'g., Fl. I, 182, p. p. — *L. gallicum* subsp. β . *corymbulosum* Shmalg., l. c. p. p. — *Cathartolinum corymbulosum* Rchb. Ic. Fl. Germ. VI (1844) 62. — Ic.: Rchb. l. c. (1844) tab. 325, f. 5169 (sub *Cathartolino*); Bonnier, Fl. Compl. Fr. Suisse et Belge, II (1912) tab. 92. — Exs.: G. R. F. No. 358; Callier, It. taur. II, No. 266.

Annual; glabrous or more or less pubescent plant, 70–50 cm high; root vertical, flexuose, slightly branching, whitish; stems single or 2–3, cylindrical, thin (1.5 mm in diameter), slightly ribbed, pale green, glabrous and smooth or scabrous with small stiff spreading hairs, branching in upper half or fourth or sometimes only at apex with branches inclined at acute angle or sometimes more or less spreading; leaves alternate, sessile, sparse, usually ascending or recurved, linear-lanceolate, abruptly tapering 129 or slightly rounded at base, long-acuminate, with 1 distinctly prominent nerve beneath, scabrous with short hairs at margins below and along midrib, otherwise glabrous, sometimes entirely scabrous beneath with very short dense hairs, glaucescent-green.

Main inflorescence loose, corymbiform-paniculate, with usually elongate branches, sparingly leafy with leaves resembling cauline leaves but smaller, few- to 50-flowered; flowers small, homogonous, on pedicels as long as or two to three times as long as calyx; sepals (3)4–5 mm long, strict, lanceolate, gradually tapering-acuminate towards apex, pale green, whitish at base, glandular-ciliate at margin, in fruit much longer than the persistent capsule, with scabrous midrib in upper part (nearly keeled); petals 6–8 mm

long, narrowly obovate, cuneate, yellow, with darker claw; stamens ca. 2.5 mm long, with ovate anthers and short filaments dilated below, annular-connnate at base; stigmas at one level with anthers, capitate; capsules ca. 3 mm long, globose-ovoid, acute, pale brown; seeds ca. 1 mm long, ovate-elliptic, flattened, pale brown with yellowish tinge, shiny. May–July.

Dry stony places and slopes, steppes, dry meadows and other herbaceous places, fields, pastures, shrubby formations, gravels. — European part: Crim.; Caucasus: Cisc., Dag., E. and S. Transc., Tal.; Centr. Asia: Mtn. Turkm. (Kopet-Dagh). Gen. distr.: Med., Bal.-As. Min., Iran., Afghanistan, N. Afr. Described from the Mediterranean area. Type unknown.

Note. *L. spicatum* (Pers. Syn. I (1806) 336; Guss., Fl. Sic. II (1828) 809), which A. Grossgeim (Fl. Kavk., V. III, 1932, p. 14) reported for E. Transcaucasia (Azerbaijan SSR, Apsheron), is closely related to this species. Not having seen the reported specimens, we decided not to include this species in "Flora of the USSR." *L. spicatum* is characterized by axillary glomerules of flowers forming together an interrupted, false spike.

30. *L. gallicum* L. Spec. pl. ed. 2 (1762) 401; Ldb. Fl. Ross. I, 422, p. p.; Shmal'g., Fl. I, 182, p. p. — *L. trigynum* L. Spec. pl. ed. 1 (1753) 279. — *L. aureum* Waldst. et Kit. Descr. et Ic. pl. rar. Hung. II (1805) 193. — *Cathartolinum gallicum* Rchb. Ic. VI (1844) tab. 326, f. 5168. — Exs.: Fl. exs. austro-hung. No. 2463; Billot, Fl. Gall. et Germ. exs. No. 734; Fiori et Beguinot, Fl. Ital. exs. No. 1522.

Annual; glabrous plant, 10–40 cm high; root vertical, thin, yellowish; stems thin, erect or ascending at base, dull green, simple or branching
130 in upper part, branches inclined at a very sharp angle; leaves alternate, sessile, linear-lanceolate, ca. 1 cm long, 1 mm wide, the lower obtuse, the upper acuminate, 1–3-nerved, slightly scabrous at margin, otherwise glabrous, lower leaves deciduous at anthesis. Inflorescence few-flowered, loose, umbelliform-paniculate, sparsely leafy; flowers on thin pedicels usually not longer than calyx; sepals ca. 2–3(4) mm long, lanceolate to ovate-lanceolate, wide at base, tapering abruptly to obtuse, mucronulate apex, awned, 3-nerved, glandular-ciliate at margin; petals about twice as long as sepals, 5–6 mm long, broadly obovate, tapering to short claw, pale yellow, white when withered; stigmas capitate; carpels and styles sometimes 3; capsules ca. 2 mm long, about two-thirds as long as calyx, globose, obtuse; seeds 2 mm long, oblong, flattened, brown. June–July.
Meadows. — Caucasus: E. and W. Transc. Gen. distr.: Centr. Eur. (Hungary), Atl. Eur. (France), Med., Bal.-As. Min., Iran. Described from Montpellier. Type in London.

Note. Although the name "*L. trigynum* L." given by Linnaeus has priority it is unacceptable because it is based on an anomalous deviated form.

Section 7. LIMONIOPSIS Planch. in Lond. Journ. of Bot. VI (1847) 598. — *Syllinum* Boiss. Fl. or. I (1867) 598. — Flowers more or less large, short-pedicel, pedicels remaining short in fruit; sepals slightly glandular-ciliate at margins; petals yellow, rarely white, usually connate

at anthesis. Leaves alternate, the lower usually spatulate, often rosetted-crowded, stipular glands usually present. Perennial or biennial herbs, often semishrubs.

Series. 1. *Flava* Juz. — Perennials (semishrubs, rarely herbs).

Subseries 1. *Orientalia* Juz. — Comparatively low semishrubs, with distinctly branching caudex, without rosettes of radical leaves at anthesis; cauline leaves mucronate at apex.

31. *L. orientale* Boiss. Fl. or. I (1867) 855; Trautv. Increm. Fl. Ross. in Tp. B. C. VIII (1883) 1, 160; Lipskii, Fl. Kavk. 262; Jávorka in Mag. Bot. Lap. IX, 155. — *L. flavum* Ldb. Fl. Ross. I (1842) 423, p. p. — *L. flavum* var. *orientale* Boiss. et Heldr. Diagn. pl. nov. ser. II, 1 (1849), 99. —? *L. mucronatum* Bertol. Misc. botan. I (1842) 18, non Gilib.; Grossg., Fl. Kavk. III, 15. — *L. flavum* et *L. tauricum* auct. fl. cauc. saltem p. p. —? *L. Balansae* Boiss. 131 Fl. or. I (1867) 855. — *L. Alexeenkoanum* E. Wulff in Byull. Mosk. Obshch. Isp. prir. XLVIII, 2–3 (1939) 17. — Ic.: Jávorka, l. c. tab. VIII, f. 3 et 15; E. Wulff, l. c. tab. p. 16 (mala).

Perennial; glabrous, glaucous plant; root fusiform, becoming woody, pale yellow; stems 9–15, rarely up to 35 cm high, becoming woody below, indurate, branching from base, ascending or rarely erect, straight or more or less flexuose, acutely ribbed in upper part, without basal rosettes of radical leaves at anthesis; lowermost leaves usually small, 4–5 mm long, oblong-ovate, tapering at base, 1-nerved; median leaves largest, 2–4 cm long, oblong-obovate, oblong or lanceolate, often asymmetrical, tapering at both ends, more or less abruptly sharpening into distinct mucro at apex, 1–3-nerved. Inflorescence 3–12-flowered, rather loose, dichasial; pedicels up to 2.5 mm long; bracts lanceolate; sepals 7–13 mm long, linear-lanceolate or narrowly lanceolate, tapering at apex to narrow mucro, with distinctly prominent midrib, white-scarious and glandular at margin; petals two and a half times as long as calyx, 18–25 mm long, long-clawed, with obovate or broadly obovate lamina, acuminate, orange-yellow; stamens of long-styled forms ca. 7–8 mm long, of short-styled 10–15 mm; stigmas linear-clavate; capsules globose, acutely ribbed, nearly as half as long as calyx, 4–5 mm long, straw-yellow, attenuate at apex and with a narrow short mucro; seeds ca. 2.5 mm long, elliptic, brown. May–July.

Dry mountain slopes, chalk and limestone outcrops. — Caucasus: E. and S. Transc. Gen. distr.: Bal.-As. Min., Arm.-Kurd. Type in Geneva.

Subseries 2. *Taurica* Juz. — Like the preceding but usually with rosettes of radical leaves; cauline leaves without mucro at apex, obtuse or acute.

32. *L. tauricum* Willd. Enum. Berol. (1809) 339; Boiss. Fl. or. I, 856, p. p.; Lipsk., Fl. Kavk. 262; Jávorka in Mag. Bot. Lap. IX, 156; Grossg., Fl. Kavk. III, 15. — *L. campanulatum* M. B. Fl. taur.-cauc. I (1808) 155, p. p. non L. — *L. flavum* Ldb. Fl. Ross. I (1842) 423,

p. p. — *L. flavum* subsp. β . *tauricum* Shmal'g., Fl. I (1895) 182,
p.p. — *L. glandulosum* β . *campanulatum* (p. p.) et γ . *tauricum*
DC. Prodr. I (1824) 425. — Ic.: Jávorka, l. c. tab. VIII, f. 4 et 16.

132 Perennial; glabrous, glaucous semishrub; root robust, woody, curved or
flexuose; caudex branching, producing sterile shoots with rosettes of leaves
and few to numerous (15) stems; stems ascending at base or erect, straight
or flexuose, strict-indurate, 10–30 cm high, sulcate, angular above, with often
conspicuously protruding ribs, usually with basal rosettes; lower leaves
crowded at base, spatulate like those of sterile shoots (rosettes), gradually
tapering at base and with broadly winged, more or less long petioles, rounded
at apex, usually with small mucro, 1–3-nerved; cauline leaves more or less
remote, oblong-obovate or (the upper) oblong or lanceolate, tapering at base,
obtuse or usually acute at apex (but not acuminate), 1- or sometimes 3-
nerved. Inflorescence 3- to 20-flowered, dichasial; bracts lanceolate; sepals
rather long, 5–9 mm, lanceolate or ovate-lanceolate, tapering at apex to a
mucro medium in length or (in Caucasian specimens) rather long, with dis-
tinctly protruding, often pectiform-winding midrib, usually blackish, narrowly
scarious and shortly-fimbriate, ciliate at margins; petals about twice as
long as calyx, 1.5–2.8 cm long, obtuse; stamens of long-styled forms 6–8 mm
long, of short-styled 8–10 mm; stigmas oblong-obovate; capsules on short
ribbed pedicels, globose, noticeably shorter than sepals, tapering at apex to
a distinct mucro, cinammon-brown when ripe; seeds ca. 3 mm long, narrowly
ovate, cinammon-brown. June.

Cliffs, stony slopes, chalk outcrops. — European part: Crim. (Sevastopol,
Simferopol, Karasubazar); Caucasus: W. and E. Transc., Cisc., Dag.,
E. Transc. Endemic. Described from the Crimea. Type in Berlin.

Note. The Caucasian material of this species is not uniform and often
not typical. It is possible that future investigations would cause a change in
this treatment.

33. *L. pallasianum* Schult. Syst. veget. VI (1820) 758; DC. Prodr. I,
428; Ldb. Fl. Ross. I, 427. — *L. pubescens* Willd. in sched. —
L. Wetschkyanum Fiek in Allgem. bot. Zeitschr. I (1895) 233. —
L. glandulosum β . *campanulatum* DC. Prodr. I (1824) 425,
p. p. — *L. tauricum* β . *Pallasianum* Boiss. Fl. or. I (1867) 856. —
L. flavum subsp. β . *tauricum* Shmal'g., Fl. I (1895) 182, p. p. —
Exs.: Dörfl. Herb. Norm. No. 3214 (nom. *L. Wetschkyanum*).

133 Perennial; low, densely cespitose semishrub, ash-gray-pubescent;
caudex much branching, bearing numerous crowded sterile shoots
and rosettes of radical leaves; stems numerous, thin, ascending,
sulcate at base, (3/7–15(20) cm high, more or less densely covered through-
out with short spreading stiff hairs; leaves of rosettes small, 15 mm long,
2–3 mm wide, spatulate, gradually tapering at base, short-petioled, usually
rounded or even slightly notched at apex (like the lower cauline leaves);
cauline leaves evenly disposed, the median and upper broadly linear, obtuse
or short-acuminate; all leaves usually 1-nerved, blue-green, more or less
covered with short simple and single or 2–3-branched stiff spreading hairs.
Inflorescence usually few-flowered; bracts acute; sepals densely ciliate at
margin and along midrib, otherwise covered with short hairs less densely
than leaves and bracts. In all other parts similar to *L. tauricum* Willd.
Fl. May, beginning of June, Fr. June and July.

Cliffs, stony slopes and ravines, limestone taluses. — European part: Crim. (eastern part — Feodosiya, Sudak and near Kokkoz). Endemic. Described from "Chersoneso heracleotico." Type unknown.

34. *L. linearifolium* Jávorka in Mag. Bot. Lap. IX (1910) 156, sensu stricto. — *L. flavum* α . *linearifolium* Lindem. Fl. Cherson. I (1881) 102, nec alibi. — *L. flavum* subsp. β . *tauricum* Shmal'g., Fl. I (1895) 182, p. p. — Ic.: Jávorka, l. c. tab. VIII, f. 17.

Perennial; glabrous green plant, with vertical root; caudex linear developing few sterile shoots with rosettes; stems ascending at base, upright, acutely ribbed, tall, 12–40(60) cm high; leaves of sterile rosettes narrowly spatulate to oblanceolate, obtuse at apex, tapering to a long petiole (frequently absent altogether); leaves remote, inconspicuously 1–3-nerved, 1.5–7 cm long, 1–4 mm wide, lower leaves of the same shape as leaves of sterile rosettes but with much shorter petioles, upper leaves (nearly) linear, tapering-acuminate at apex. Inflorescence loose, 7–20-flowered, with branches distinctly elongated in fruit; sepals 5–7 mm long, tapering to thin rather long mucro, with a protruding dorsal midrib; petals 1.7–2.2 cm long, usually rounded at apex, rarely acuminate; stamens of long-styled forms ca. 7 mm long, of short-styled 1–1.2 cm; capsules ca. 4 mm in diameter, with rather short beak (ca. 1 mm), sometimes half as long as sepals. In all other parts similar to *L. tauricum* Willd.

Limestones, stony slopes, clayey banks of rivers and estuaries. — European part: Bl. (Odessa, Kherson, Nikolaev), Crim. (N.). Endemic. Described from Odessa (Lang and Shovitz specimens). Type in Vienna, duplicate type in Leningrad; Lindeman's variety-type in Leningrad.

35. *L. basarabicum* (Săvul. et Rayss) Klok. in mss. — *L. flavum* ssp. *tauricum* a) *basarabicum* Săvulescu et Rayss, Mater. pentru fl. Basarab. (1934) 140. — Ic.: Săvul. et Rayss, l. c. f. 6.

134 Perennial; stems few, 20–50 cm high, glabrous; lower (radical) leaves usually dying at anthesis; cauline leaves oblong-elliptic, 3–5 cm long, 5–8 mm wide, gradually tapering to a short petiole, rather short-acuminate towards apex, mucronate, with 3 and in the lower part 5 conspicuous nerves, glabrous. Bracts linear-subulate, with flattened tubercled cilia at margin; flowers 2–20(25) (on one stem); sepals lanceolate or linear-lanceolate, with thin subulate awn, 6–8 mm long; petals obovate, 13–20 mm long, short-clawed; capsules subglobose, with short beak, ca. 4 mm long. June–July.

Steppical slopes, limestone outcrops. — European part: Bes., M. Dnp. (SW). Endemic. Described from Bessarabia. Type in Bucharest.

Note. We have not seen the herbarium material of this species and consider it extremely critical. The description is partly similar to that of *L. flavum* L.

36. *L. ucranicum* Czern. Consp. (1859) 12, p. p.; Gruner in Bull. Soc. Nat. Mosc. XLI, 2 (1868) 130. — *L. ucranicum* α . *glabrum* Czern. l. c. — *L. flavum* α . *linearifolium* Lindem in Bull. Soc. Nat. Mosc. 38, 1 (1865) 180. — *L. linearifolium* Jávorka in Mag. Bot. Lap. IX (1910) 156, p. p. — *L. tauricum* auct. plur. non Willd. — *L. flavum* subsp. β . *tauricum* Shmal'g., Fl. I (1895) 182, p. p. — Exs.: G. R. F. No. 1461.

Perennial; semishrub with robust woody root; caudex strongly branching, developing short to rather long, usually lilac sterile shoots bearing rosettes of leaves, and a few to many (1–8) stems; stems usually lilac, 4–30 cm high, slightly ascending at base or erect, straight or slightly curved, rather thin, shallowly sulcate, glabrous below, usually with leaf-rosette at base; basal leaves like those of sterile shoots (or rosettes) narrowly spatulate or oblanceolate, 1–3 cm long, 1.5–4(5) mm wide, gradually tapering at base to rather narrow and long petiole, rounded or acute at apex, usually 1-nerved or obscurely 3-nerved; cauline leaves 0.5–3 mm long, more or less remote, oblanceolate or linear-lanceolate to sublinear, obtuse to rather acute, 1-nerved, all leaves glabrous, glaucous-green. Inflorescence 5–30-flowered, loose, dichasial, with thin branches distinctly elongating in fruit; flowers 1.3–2.3 cm long; sepals short, 3–6 mm long, lanceolate or ovate-lanceolate, tapering and short-mucronate at apex, with faintly or only proximally protruding midrib, dark green, ciliate and narrowly scarious at margin; petals with narrowly obovate blade, very thin, 135 obtuse; stamens of long-styled forms 5–6 mm long, of short-styled 7–10 mm; stigmas oblong; capsules on short acutely ribbed pedicels, as long as or hardly longer than sepals, globose, tapering at apex to rather long beak. May–July.

Chalk outcrops. — European part: M. Dnp., V.-Don. Endemic. Described from Svyatye Gory. Type in Kharkov.

37. *L. czerniaëvii* Klok. in Bot. Zhurn. Ukr. AN, III, No.1–2 (1946) 24. — *L. ucranicum* β . pubescens Czern. Consp. (1859) 12. — *L. Pallasianum* E. Wulff in sched. et mss. p. p. non Schult.

Perennial; semishrub with densely short-hairy leaves; root robust or rather thin, woody, usually flexuose; caudex bearing many short rosette-like sterile shoots and erect or slightly ascending curved stems, (10)15–30 cm high, slightly ribbed; leaves 1–4 cm long, 1–7 cm wide, thick, coriaceous, radical and lower cauline leaves obovate and tapering to winged rather long petiole, cauline leaves oblanceolate to linear, abruptly angustate and short-acuminate at apex, lower leaves 3–(5) nerved, upper leaves 1-nerved. Inflorescence generally few-flowered, loose; sepals lanceolate or ovate-lanceolate, subulate at apex, (4)5–6.5 mm long, with prominent midrib below, profusely glandular-ciliate at margin; petals pale yellow, 15–20 mm long; capsules 5–7 mm long, as long as or slightly longer than calyx; seeds ca. 2.5 mm long. In all other parts similar to *L. ucranicum* to which it is closely related, differing mainly by the pubescence. May–July.

Stony outcrops (limestones, granite, chalk). — European part: V.-Don, Bl., L. Don. Endemic. Described from the Donets region near Beloyarivka, along the Krynka River. Type in Kharkov.

Note. Forms that appear to be intermediate between this species and *L. flavum* L., and may possibly be of hybrid origin, have been found. They differ from *L. czerniaëvii* by more robust habit and sparser pubescence.

38. *L. uralense* Juz. nov. spec. in Addenda XIII, 722. — *L. tauricum* Korsh. Tentam. Fl. Ross. or. (1898) 38, non Willd.

Perennial; semishrub with short or often rather long sterile shoots bearing rosettes of crowded, spatulate, glaucous leaves 1–3.5 cm long,

2–7 mm wide, in general somewhat broader and with shorter petiole than in *L. ucranicum*; stems 6–20 cm high; cauline leaves also somewhat broader than in *L. ucranicum*, 4 mm wide, 1-nerved or obscurely 3-nerved. Inflorescence generally few-flowered, compact at first, with branches later elongating but still shorter and thicker than in *L. ucranicum*, 2.5 cm long; sepals often blackish-green, rather wide, ovate-lanceolate to ovate; petals broader and thicker than in *L. ucranicum*; capsules tapering at apex to short beak. In all other parts similar to *L. ucranicum* Czern. June.

Limestone and chalk outcrops, stony slopes. — European part: Transv. (?), V.-Kama. Endemic. Described from S. Urals. Type in Leningrad.

Series 2. *Eu-flava* Juz. — Herbs, mostly of high steppes with unbranched or relatively few-branched caudex.

39. *L. flavum* L. Sp. pl. ed. 1 (1753) 279; Ldb. Fl. Ross. I. 423 p. p.; Boiss. Fl. or. I, 855; Shmal'g., Fl. I, 182. — *L. campanulatum* Pall. It. I (1771) 194, 202, non L.; M. B. l. c. p. p. ex Boiss. l. c. — *L. monopetalum* Steph. Enum. stirp. agri mosq. (1792) No. 214. — *L. glandulosum* ε. *flavum* DC. Prodr. I (1824) 425. — *Xantholinum flavum* Rchb. Ic. VI (1844) 67. — *L. flavum* γ. *ovatum* Lindem. in Bull. Soc. Nat. Mosc. I (1865) 180. — *L. flavum* β. *lanceolatum* Lindem. in Bull. Soc. Nat. Mosc. II (1867) 488. — *L. flavum* β. *latifolium* Beck. Fl. Nieder-Oesterr. (1892) 566. — *L. flavum* α. *typicum* Fiorie Paoletti Fl. anal. Ital. II (1901) 251. — *L. flavum* var. *angustifolium* Jávorka in Mag. Bot. Lap. IX (1910) 153. — Ic.: Bot. Mag. IX (1795) tab. 312; Rchb. l. c. (1844) tab. 341; f. 5175; Jávorka in Mag. Bot. Lap. IX (1910) tab. 8, 9, f. 1, 9, 13. — Exs.: G. R. F. No. 95, 96, 1462.

Perennial; plant wholly glabrous; root fusiform, horizontal to nearly vertical, becoming woody, yellowish; caudex usually few-branched, developing both flower-bearing stems and short sterile leafy shoots; stems two to several, 20–60 cm high, erect or sometimes slightly ascending at base, straight, firm, yellowish-green, often with lilac tinge, simple below, branching in upper half or usually only at apex, branches inclined at an acute angle, multiangular and ribbed, sometimes nearly winged, with scabrous, rarely (especially in upper part of stem) smooth ribs; lower and median leaves 2–4.5 cm long, 0.4–1.2(2.2) cm wide, narrowly obovate to spatulate, sessile, tapering at base, obtuse or acute; uppermost leaves lanceolate, acute, not (nearly) or hardly tapering at base, 1.5 cm long, 0.2 cm wide, all entire, glaucescent, transparent (especially at base), smooth or scabrous margin, obsoletely 3-nerved (the lower sometimes 5-nerved), with 2 dark brown stipular glands. Flowers in umbellate or paniculate, few-leaved cymes; pedicels short, erect, ribbed, 2–4 mm long; sepals lanceolate or narrowly ovate, 6–9 mm long, long-acuminate, with prominent midrib, narrowly membranous, ciliate at margin; petals cuneate-obovate, tapering to rather long claw, 12–20(22) mm long, three to four times as long as calyx, yellow; stamens of long-styled forms ca. 6–8 mm long, of short-styled 8–12 mm; anthers 1.5–2 mm long, narrowly ovate, sulphur-yellow; styles of short-styled forms 6–8 mm long, of long-styled 8–11 mm, with short-linear stigmas

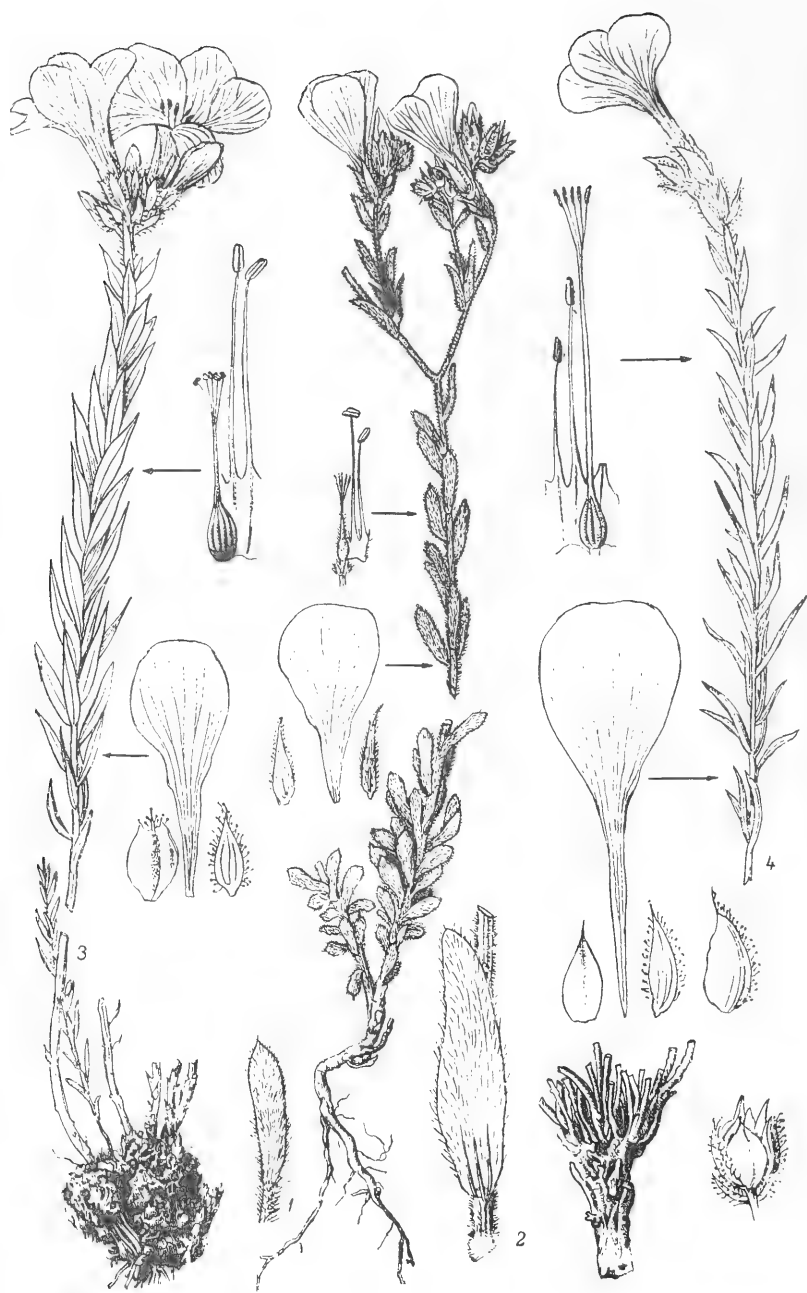


PLATE VIII. 1 - *Linum lanuginosum* Juz., habit, details of flower; 1a - cauline leaf; 2 - *L. hirsutum* L., lower part of plant, 2a - cauline leaf; 3 - *L. heterosepalum* Rgl., habit, details of flower of short-styled form; 4 - *L. olgae* Juz., habit, root-neck, details of flower of long-styled form and capsule.

cuneate at base; capsules broadly ovoid or globose, brown, 4–5 mm long, usually two-thirds as long as calyx, tapering to a short beak at apex, with pubescent inner walls; seeds oblong, 1.8–2.2 mm long, ca. 1 mm wide, obliquely ovate, smooth, brown. June–August.

Meadows and steppes, steppe glades, dry or rather moist meadows, exposed forest clearings, edges of forests, loose shrubby formations, herbaceous, often pebbly slopes, ravines, gullies, limestones, chalks. — European part: U. V., V.-Kama, U. and M. Dnp., V.-Don, Transv., Bes., U. Dns., Bl., L. Don, L. V.; Caucasus: Cisc., Dag. Gen. distr.: Centr. Eur. (Hungary), Med. (N. Italy), Bal.-As. Min. Described from Austria. Type in London.

Economic importance. Cultivated in gardens as an ornamental plant.

Note. See Note above in reference to this species hybridizing with *L. czerniaëvii* Klok. Apparently there is also hybridization with *L. ucranicum* Czern.

Series 3. *Nodiflora* Juz. — Annual herbs.

40. *L. luteolum* M. B. Fl. taur.-cauc. I (1808) 256; DC. Prodr. I, 424; Grossg., Fl. Kavk. III, 14. — *L. nodiflorum* Ldb. Fl. Ross. I, 423, non L.; Boiss. Fl. or. I, 853, p. p.; Shmal'g., Fl. I, 182. — *L. pusillum* Pall. Ind. Taur. 1800 (ex M. B. l. c.).

Annual; glabrous plant; root vertical, flexuose, whitish; stems 7–30(40) cm high, usually solitary but sometimes branching from base and appearing 2–5-stemmed, ascending below than erect, sympodially branching above, angular, with very narrowly winged crenate and papillate-scabrous ribs; leaves alternate, 4–30 mm long, 1–8 mm wide, lower leaves spatulate to oblong-spatulate, obtuse, upper leaves lanceolate to broadly linear, sessile, acuminate, all leaves with 2 brown stipular glands at base, glabrous, pale green, 1–3(5) nerved, finely and generally acutely toothed at margin and beneath along midrib. Inflorescence a very loose dichasium becoming a bostryx, (1)5–25-flowered; bracts two at base of each flower, as long as or longer than calyx; pedicels very short (up to 2 mm); flowers 15–20 mm long; sepals 8–15 mm long, oblong-linear-lanceolate, glabrous, below dilated and white-membranous along margin, with keeled midrib, finely toothed at margins and along keel, mucronulate, three to four times as long as capsule; petals about twice as long as calyx, cuneate-obovate, with long claws connivent to form a tube and blades somewhat angular at apex, golden yellow or sometimes white; stamens 6–8 mm long (above base of flower), filaments connate forming a tube; anthers elliptic; styles slightly shorter than stamens, with capitate stigmas; capsules ca. 6 mm long, ovoid-globose, short-beaked. May–June.

Open, dry, stony and clayey places and shrubby formations, mountain slopes, hills, roadsides, fields. — European part: Crim. (?); Caucasus: Cisc., Dag., E., W. and S. Transc. Gen. distr.: Bal.-As. Min., Iran. Described from the Caucasus. Type in Leningrad.

Note. Most of the Caucasian specimens of *L. luteolum* M. B. are easily distinguished from the original W. Mediterranean *L. nodiflorum* L. The Crimean plant referred to as *L. pusillum* Pall. occupies

an intermediate position between the two species. Critical study is required. The report of *L. nodiflorum* L. from Odessa (Lindemann. Fl. Chersonensis, I, 1881, p.102, and others) is probably an error.

Section 8. *DASYLINUM* Planch. in Lond. Journ. of Bot. VI (1847) 598. — Flowers large; sepals distinctly and usually densely glandular-ciliate at margin; petals blue or reddish-pink, connate; stigmas linear; leaves alternate, without stipulary glands, not crowded like rosettes at base of plant. Annual or perennial herbs, usually with more or less pubescent leaves. The Russian species of this section apparently belong to the same species group that could be called "Hirsuta Juz."

41. *L. hypericifolium* Salisb. in Paradis. Lond. (1806) tab.79; Sims. in Curtis Bot. Mag. XXVI (1806) 1048. — *L. venustum* Andrews, Bot. Repos. (1807) tab.477. — *L. hirsutum* M. B. Fl. taur.-cauc. I (1808) 256; ibid III (1819) 254, et auct. mult. fl. Cauc. non L. — *L. hirsutum* β . *latifolium* Ldb. Fl. Ross. I (1842) 424, p. p. — *L. hirsutum* γ . *subglabrum* Ldb. l. c. — *L. viscosum* δ . *hypericifolium* DC. Prodr. I (1824) 426. — *L. lazicum* Boiss. in Balansa, Pl. exs. [cfr. Boiss. Fl. or. Suppl. (1888) 138]. — Ic.: Bot. Mag. XXVI (1807) tab.1048; Salisb. l. c. — Exs.: Herb. Fl. Cauc. No.380, 380^b; Pl. orient. exs.No.160.

- 141 Perennial; roots usually oblique, flexuose, branching, woody, yellowish radix nodose-tuberculate, few-branched; stems 20–70 cm high, single or usually few, erect, straight, cylindrical, finely sulcate, pale green often partly lilac, usually glabrous below, more or less densely villous above with long, white, spreading, slightly curly hairs, usually leafless in the lower part at anthesis, rather densely leafy above, shortly branched at apex; sterile shoots elongating to half the length of stem, densely leafy; leaves usually 1.5–2.5 cm long, 3–8 mm wide, the lower oblong-ovate, rounded at base, obtuse, upper leaves the same shape or often ovate-lanceolate, acute, mostly 5-nerved, bright green, densely soft-hairy to subglabrous at both sides. Main inflorescence paniculate or nearly pseudo-umbellate, formed of more or less dense, approximate, individual pseudo-racemes, short at first, later elongating; bracts lanceolate, densely villous or covered with long white soft hairs and glandular-ciliate margin; pedicels erect, short; flowers heterodistylous; sepals ovate or ovate-lanceolate, somewhat acuminate, pale below, blackish-green above, densely and softly villous, densely glandular-ciliate at margin; petals 1.8–2.2 cm long, broadly obovate, gradually cuneate-tapering to rather long claw, pale purple with darker nerves and yellowish claw; capsules 5–6 mm long, half as long as calyx, globose, nearly beakless, usually more or less hairy (at least in upper part). June–August.

Subalpine (tall herbaceous cover) and lower alpine meadows and pastures, mountain forests, forest glades, mountain slopes, cliffs, rock streams. — Caucasus: Cisc., Dag., E., W. and S. Transc. Gen. distr.: Bal.-As. Min., (Lazistan). Described from the Caucasus. Type probably in London.

Economic importance. This species and the others in this section are highly ornamental plants.

Note. The considerable variability of this plant is apparently due to the diversity of its habitats; however, we were unable to observe any clear-cut distinctions separating them into forms or races.

42. *L. hirsutum* L. Sp. pl. ed. 1 (1753) 277; Shmal'g., Fl. I, 183, p.p. — *L. hirsutum* β . *latifolium* Ldb. Fl. Ross. I (1842) 424, p.p. —
142 *L. hirsutum* α . *genuinum* Neilr. Fl. Wien (1846) 508. — *L. hirsutum* α . *typicum* Beck. Fl. Nieder-Oesterr. (1892) 567. — Ic.: Jacq. Fl. Austr. I (1773) tab. 31; Rchb. Ic. VI, tab. 333, f. 5166. — Exs.: GRF No. 310.

Perennial; root short, thin to rather thick, 3–10 cm [?] in diameter, fusiform, smooth, more or less strongly branching below; radix usually branching; stems cylindrical, when dry slightly sulcate, yellowish-pale green, very often becoming lilac, usually glabrous, sometimes sparsely covered towards base with long spreading stiff hairs and densely short-hairy above with curly hairs, few-branching from the middle or only at apex, branches elongating post anthesis; flower-bearing stems up to 10, rarely solitary, slightly arcuate, ascending at base to erect, straight, 8–40 cm high, 1.3–5 mm in diameter, not densely leafy; sterile stems half as long as the flower-bearing ones, densely leafy; leaves 4 mm–5 cm long, 1.5–12 mm wide, erect or spreading, sessile, the lowermost pale, soon deciduous leaving rather approximate scars, the lower leaves ovate-oblong to oblong-obovate, tapering at base, obtuse, the upper ovate to linear-lanceolate, usually rounded, acute at base, 3-nerved, entire, gray-green, sparingly to sometimes densely covered, with long straight hairs, sometimes subglabrous, uppermost leaves (bracts) with fine stalked glands at margins. Inflorescence loose, 10–35-flowered, forming helical panicles; flowers erect on short, densely short-hairy pedicels, remote, heterodistylous; sepals 6–9 mm long, herbaceous, lanceolate, long-acuminate, densely covered with loosely contiguous hairs on the lower surface and at the upper half also above, gray-green, glandular-ciliate at margins of the upper half; petals about three times as long as sepals, 20–28(30) mm long, cuneate-obovate, gradually tapering to claw, pale blue with darker nerves and yellow claw; stamens of long-styled forms 7–10 mm long, of short-styled 10–15 mm long, connate at base, with thin linear appendages between filaments; anthers ovate-elliptic; styles ca. 10–16 or 5–11 mm long, partly pubescent, thin-filiform at the lower part; stigmas linear-oblong; ovary short-hairy in upper half; capsules ca. 4–5 mm long and wide, globose, acuminate at apex, yellowish or pale brown, hairy above; seeds oblong, 2.5 mm long, flattened, smooth, rather dull, dark brown. June–July. (Plate VIII, Figure 2.)

- 143 Steppes, meadows, shrubby formations, chalk outcrops, dry hills and slopes. — European part: U.Dns., M.Dnp., V.-Don. Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Austria (and "Tatary"). Type in London.

Note. Populations of this species in the eastern part of its distribution area are apparently adapted to cretaceous soils. The cretaceous forms (*L. cretaceum* Juz. ined.) differ slightly from the typical, more western meadow-steppe forms to which the above description refers. The leaves are the most different, being narrower, very often 3-nerved, slightly more obtuse (especially the upper ones). Plants with (sub-)glabrous leaves grow

frequently together with typically pubescent ones. These forms should not be separated as yet, since the material at hand is very diverse and at the same time insufficient to permit a final evaluation of their taxonomic significance.

43. *L. lanuginosum* Juz. n. sp. in Addenda XIII, 723. — *L. hirsutum* α . *angustifolium* Ldb. Fl. Ross. I (1842) 424. — *L. hirsutum* auct. fl. Taur.; Shmal'g., Fl. I (1895) 183, p. p.

Perennial; stems 5–40 cm high, solitary or few, erect or usually slightly arcuate-ascending at base, densely and shortly lanate-hairy, densely leafy or below with dense traces of fallen leaves; leaves sessile, tapering to base, the lower narrowly obovate or spatulate, rounded at apex, upper leaves oblong, obtuse or acute at apex, all leaves usually 3-nerved, gray-green, densely spreading-hairy at both sides, uppermost leaves usually with few remote stalked glands at margin. Axis of inflorescence and the very short pedicels densely spreading-hairy; sepals lanceolate, long-acuminate outside and inside in the upper part pubescent as in inflorescence (hairs longer and more spreading than in *L. hirsutum*), rather densely glandular-ciliate at margins of the upper part. In all other parts like *L. hirsutum* L. Fl. May–July, Fr. June–August. (Plate VIII, Figure 1.)

Stony (limestone) slopes and taluses, ravines, steppes, open hills. — European part: Crim.; Caucasus: W. Transc. (Novorossiisk). Described from the Crimea. Type in Leningrad.

Section 9. *MACRANTHOLINUM* Juz. in. Not. Syst. ex Herb. H. Bot. Petrop. II (1921). — Flowers large, heterostylous; sepals unequal, the outer herbaceous, lanceolate, glandular-ciliate at margin, the inner broadly ovate, white-membranous at margin, with a single stalked gland at apex; stigmas capitate. Perennial, glabrous plants, otherwise similar to sect. *Dasylinum*.

This section includes only one series that might be called "*Heterosepala* Juz."

- 144 44. *L. heterosepalum* Rgl. in Tr. B. S. II, 2 (1873) 433; Trautv. Increm. Fl. Phaenog. Ross. IV in Tr. B. S. IX, 1 (1884) 373, p. p. — *L. heterosepalum* subsp. *tianschanicum* Vved. in Sched. ad Herb. Fl. Asiae Med. III (1925) No. 71. — Exs.: Edit. H. Bot. P. M. No. 80; H. F. A. M. No. 71.

Perennial; root short, 1–4 cm thick, nodose, strongly branching from base; stems few to many, erect, the sterile stems 5–40 cm high, flower-bearing stems 13–60 cm high, 1.5–5 mm in diameter, usually straight, rarely flexuose, cylindrical, slightly sulcate when dry, pale green or straw-yellow at base, glabrous, densely leafy; leaves many, sessile, the lower small, squamiform, nearly membranous, ovate or ovate-lanceolate, obtuse, median leaves herbaceous, linear-lanceolate or lanceolate, 1–4 cm long, 1.5–10 mm wide, often the upper much wider than the lower, 3–5-nerved, acute, usually bright green, very rarely glaucescent, glabrous, smooth at margin, uppermost leaves smaller, intergrading into bracts, also smooth at margin, generally greenish, glandular-hirsute with bristles usually ca. 1 mm long, and with small globose brown or rarely blackish glands.

Inflorescence 3–15-flowered, with reduced branches, usually dense; flowers large, 2–4.5 cm long, erect, short-pedicel, clustered; sepals unequal, the two outer herbaceous, lanceolate or ovate-lanceolate, acute, glandular-hispid-ciliate at margin, the third sepal ovate, acute, glandular-hispid-ciliate inside and usually smooth outside, the two inner sepals broadly ovate or obovate, acuminate or rounded at apex, broadly white-membranous at margin, smooth, bearing only one glandular bristle at apex (bristles the same as in upper leaves and bracts); petals four times as long as sepals, rather long-clawed, limb pink or lilac-white, narrowly obovate, nearly twice as long as wide, tapering gradually to broad claw three-fourths as long as limb, distinctly nerved, "tube" of corolla narrowly obconical, 4–7 mm in diameter at the middle; stamens of long-styled forms 1–2.3 cm long, of short-styled 1.5–3.5 cm; anthers 1.5–2 mm long, ellipsoid, yellow; pistils of long-styled forms 1.5–3.5 cm long, of short-styled forms 1–2.3 cm, all 5-partite above; stigmas 0.3–1 mm long, capitate, globose or usually ovoid or ellipsoid; capsules subglobose or ovoid, long-acuminate, 0.8–1.3 cm long, becoming brown when ripe; seeds ca. 5 mm long, flattened-ovate or elliptic, brown. Fl. April–July, Fr. July–August. (Plate VIII, Figure 3.)

Mountain steppes, subalpine or forest meadows, forest edges, and herbaceous mountain slopes. — Centr. Asia: Dzu.-Tarb. (Dzungarian Ala-Tau, T. Sh. (C. T. Sh., Kirghizian Ala-Tau). Gen. distr.: Dzu.-Kash. (Chinese Turkestan). Described from the Tyube River and the vicinity of Kopal. Type and paratype in Leningrad.

Economic importance. This and the following species are highly ornamental plants which should be cultivated.

45. *L. olgae* Juz. in Bot. Mat. Gerb. Bot. Sada. II, 6 (1921) 21. — *L. Fedtschenkoae* Rgl. ex A. P. Fedchenko in Izv. Obshch. Lyubit. Est. Antropol. i Etn. X, No. 1 (1872) 81, nomen solum; idem in Brodovskii, Ivanov. Krauze and A. Fedchenko, Kat. Turkest. Otd. Politekh. vyst. (1872) 8, nomen solum. — *L. Fedtschenkowae* Korolkow ex C. Koopmann in Monatsschr. d. Vereins z. Beförd. d. Gartenbaues in d. Kgl. Preuss. Staaten, 22 (1879) (non vidi). — *L. heterosepalum* Trautv. in Tr. B. S. IX, 1 (1884) 873, p. p. (quoad pl. Franchetianam) et auct. plur. fl. Turkest. non Rgl. l. c. — *L. heterosepalum* var. *purpureum* Franchet in Ann. d. sc. nat. IV sér. Botan. XV, No. 24 (1883) 242. — *L. heterosepalum* subsp. *Olgae* Vved. in Sched. ad Herb. Fl. Asiae Med. III (1925) No. 71.

Perennial; root long, 0.5–2 cm thick, subcylindrical, smooth, woody, branching only at depth; stems usually many or very many, 10–75, arcuately ascending, not as long as in the preceding species, flower-bearing stems 11–45 cm high, sterile stems 3–25 cm high, straight or often curved, sometimes flexuose, thinner and more delicate than in the preceding species, 1–3 mm in diameter, straw-yellow at base, otherwise pale green; lowermost leaves very small, submembranous, median leaves herbaceous, linear-lanceolate, smaller than in the preceding species, 0.7–3.5 mm long, 1–5 mm wide, 1–3-nerved, rarely 5-nerved at base, the lower obtuse, the upper acute, glaucous-green, uppermost leaves smaller and intergrading into bracts, both glandular-bristly-ciliate at margin with bristles 1–2 mm long, greenish

or blackish, and glands usually slightly larger than in the preceding species, obovoid or elliptic, usually blackish. Inflorescence 1-7- (rarely 9-)flowered, more or less loose, branches not short; flowers erect, short-pedicelled, large, 2.5-5 cm long, with corolla four times as long as calyx; sepals as in the preceding species; petals long-clawed, limb pink or lilac-pink, broadly obovate, only one and a half times as long as wide, abruptly tapering to narrow claw of the same width throughout its length, usually equal to limb in length, inconspicuously nerved, "tube" of corolla (formed by claws) longer and narrower than in the preceding species, subcylindrical, 2.5-5 mm in diameter; stamens of long-styled forms 1.3-2.5 cm long, of short-styled 2-3.5 cm; anthers 2-3 mm long; 146 styles of long-styled forms 2-3.5 cm long, of short-styled 1.3-2.5 cm; stigmas 0.5-1 mm long, ovoid or ellipsoid; capsules 1-1.5 cm long. In all other parts resembling the preceding species. Fl. May-July, Fr. June-July. (Plate VIII, Figure 4.)

Clayey and stony slopes, cliffs, in subalpine and forest meadows and grass lands. - Centr. Asia: T. Sh. (Talas Ala-Tau, Tashkent Ala-Tau, Fergana Range), Pam.-Al. Endemic. Described from Zeravshan and Alai Range. Type and paratype in Moscow, cotype and paratype in Leningrad.

Note. A. I. Vvedenskii (l. c.) tried to prove that *L. heterosepalum* Rgl. (as we understand it) and *L. olgae* Juz. are intergraded by intermediate forms and hence are only "subspecies" of *L. heterosepalum* Rgl. We do not think that the occurrence of intermediate forms between two species (including the vicarious) should in any way reduce their taxonomic status or should be reflected in their name (in particular, by changing the binary nomenclature applied to them). Apparently, it is not the presence of intermediate forms that is pertinent to this case, but merely the manifestation of "transgressive characters" of two species that are perfectly defined in nature and always easily distinguished from each other by an assemblage of "combined characters." In his "analysis" of their distinctions, Vvedenskii makes no mention of the hypogean organs of these species, the morphology of which obviously plays a role in the determination of dubious cases.

Family LXXXII. **ZYGOPHYLLACEAE*** LINDL.

Flowers regular; sepals 5 or 4, usually imbricated; petals as many as sepals, usually imbricated, sometimes completely absent; stamens as many as petals, sometimes double, rarely three times in number, scale-like below; ovary usually 3-5-locular, each cell with 1 to many pendent ovules, passing over to sulcate or angular style, sometimes with capitate-dilated above. Fruit rarely baccate, usually dehiscent by valves or separating into fruitlets; seeds albuminous or exalbuminous. Herbs, annuals, semishrubs or shrubs, with opposite, rarely alternate leaves; leaves stipulate, rarely not parted or imparipartite, usually paripinnate,

* Treatment by E.G. Bobrov, except for the genus *Zygophyllum*, which was treated by A.G. Borisova.

fleshy. Flowers terminal, in axillary cymes or forming racemes or dichasia, sometimes 1–2 in axils of leaves.

The family includes more than 290 species of 28 genera, nearly half of which are monotypic.

147 Key to Genera

- 1. Fruit a drupe with 1-seeded stone 842. *Nitraria* L.
- + Fruit a dehiscent or indehiscent capsule, rarely a fleshy berry . . . 2.
- 2. Fruit a fleshy 3-locular berry; shrub with spreading branches,
leaves dissected into linear lobes 838. *Malacocarpus* Fisch. et Mey.
- + Fruit a capsule 3.
- 3. Small annual plants (5–15 cm high); leaves few, alternate, whorled on
branches, up to 10 mm long, incised or entire, linear to oblanceolate
. 839. *Tetradolus* Stev.
- + Large perennial (very rarely annual) herbs or shrubs; if annuals or
biennial then leaves paripinnate and stems spreading 4.
- 4. Fruit separating into 5 fruitlets, provided with spines and prickles
or with pectinate-dentate wings at margins 841. *Tribulus* L.
- + Fruit globose, 3-locular and 3-valvate; stamens 15; leaves dissected
into 3–5 lanceolate-linear acuminate lobes 837. *Peganum* L.
- ++ Fruit a trihedral-pentahedral capsule; stamens 8–10; leaves uni-
parous or multiparous, rarely simple 840. *Zygophyllum* L.

Subfamily 1. **PEGANOIDEAE** Engl. in E. P. Pflanzenfam. III, 4 (1890) 90; Ibid. 19, a (1931) 153.—Stamens in two circles, the outer twice as many as the inner; fruit globose, dry, dehiscent by 3 valves or bacciform-indehiscent.

Genus 837. **PEGANUM** * L.
L. Spec. plant. (1753) 444.

Calyx 5-sect nearly to base into linear lobes, lobes entire or hardly incised or pinnatisect, persistent in fruit; corolla pentapetalous; stamens 15, with filaments dilated at base; style trihedral above; fruit a 3-locular, 3-valved capsule with numerous seeds. Perennial herbs, with leaves cut into linear lobes.

This genus includes 6 species distributed in the eastern hemisphere from the Mediterranean area to Mongolia, and in S. America.

- 148 1. Glabrous plant, leaves dissected into 3–5 linear lanceolate lobes;
calyx lobes entire or hardly incised 1. *P. harmala*** L.

* From the Greek *Peganon* — Dioscorides' name for rue.
** Arabic name of this plant.

- + Plant shortly and densely hispid, appearing spiny; leaves 2- or 3-sect into linear acuminate lobes; calyx lobes incised into 5-7 lobes
2. *F. nigellastrum* Bge.

1. *P. harmala* L. Sp. pl. (1753) 444; M. B. Fl. taur.-cauc. I, 364; Ldb. Fl. Ross. I, 489; Boiss. Fl. or. I, 917; Shmal'g., Fl. I, 189; Grossg., Fl. Kavk. III, 16; Kryl., Fl. Zap. Sib. VIII, 1850. — Ic.: Fl. Yugo-Vost. V, 650; Sornye rast. SSSR. III, 248. — Exs.: G. R. F. No. 862; Fl. cauc. exs. No. 313.

Perennial; radix up to 2 mm long, multicipital, producing few stems; stems 20-50 cm high, straight or flexuose, spreading, strongly branching, glabrous, smooth, slightly sulcate; stipules of lower leaves more distinct, small, lanceolate, sometimes incised; leaves ovate, 3-6 cm long, dissected into 3-5 lanceolate-linear acuminate lobes 1-3.5 cm long, 1.5-3 mm wide, lobes slightly incised. Flowers 1-3 apical at many branches, on 1-2 cm long pedicels thickened at apex; calyx deeply 5-sect, lobes linear, 1.5-2 cm long, sometimes slightly incised or nearly ternate; corolla pale yellow; petals elliptic, obtuse, 1.5-2 cm long, 6-9 mm wide; capsules globose, slightly flattened above, distinctly 3-valved, 0.6-1 cm in diameter; seeds numerous, dark brown. Fl. May-July, Fr. July-August.

In the southern steppe zone, in semideserts and deserts, frequently on solonchik soils; usually found in farming areas, near huts on pastureland, oases; in the mountain regions reaching the submontane belt. — European part: Transv. (S.), Bes., Bl., L. Don (S.), L. V., Crim.; Caucasus: Cisc., Dag., W. Transc. (rarely), S. and E. Transc., Tal. (?); W. Siberia: U. Tob. (SW); Centr. Asia: everywhere except for the high mountains, in oases and nomadic camps in desert plains of the south. Gen. distr.: W. Med. (rarely), E. Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Dzu.-Kash., Mong. (W.). Described from the Mediterranean area (Madrid, Alexandria, etc.). Type in London.

149 Economic importance. Harmal is an obnoxious weed that is widespread in villages and pasturelands and avoided by all farm animals except for camels. This plant is poisonous for animals. It contains such alkaloids as harmine, harmel and harmalol. As a ruderal and segetal weed it also occurs among field crops. The seeds yield a red dye that is used in dyeing wool.

Note. Another species, very closely related to the Russian harmal, occurs in the Alashan Mountains in S. Mongolia and the eastern part of Kansu province in W. China, which Maksimovich described as a variety of the Russian harmal under the name "*L. harmala* β . *multisecta* Maxim." (Flora tangutica, 1889, 103) Maksimovich's plant is distinguished by its 2- and 3-sect leaves and its 3-5-sect calyx-lobes. These morphological unique features of this plant plus its specific distribution area indicate its being an independent taxon that should be distinguished as a separate species. We propose to name it "*P. multisectum* (Maxim.) Bobr." (= *P. harmala* β . *multisecta* Maxim.).

In the extreme southwestern area of *P. harmala* L., Arabia to India, there are plants that differ from the typical by their narrow, linear-filiform leaf lobes. Specimens similar to these were referred by Boissier to *P. harmala* β . *stenophyllus* (Boiss. Fl. or. I, 1867, 917). This is also, apparently, a case of isolation of a separate race.

2. *P. nigellastrum* Bge. in Mém. Acad. Pétersb. par div. sav. II (1835) 87.

Perennial; radix straight, multicapital; stems 10–25 cm high, numerous, slightly branching, flexuose, usually covered with short bristles; stipules lanceolate, hardly discernible and only in lower leaves; leaves many, orbicular, 1.2–1.8 cm long, dissected into 3–5 linear straight acuminate lobes, lobes dissected into linear-acuminate lobules, the whole plant appearing spinous, lobes sparingly short-hispid. Flowers rather large, solitary, terminal on branches; pedicels densely and shortly hispid; calyx lobes lanceolate, ca. 1.5 cm long, cut into 5–7 linear lobules; petals yellow (?), 12–15 mm long, oblanceolate, rounded at apex, ca. 7 mm wide above; capsules sessile, globose, flattened above; seeds many, irregularly fusiform, curved, angular edged, dark brown, finely tuberculate, up to 3 mm long. Fl. May, Fr. August.

Sandy and gravelly deposits in river valleys, sometimes on solonchets; rocky slopes in the lower mountainous area. — E. Siberia: Dau. (near Kyakhta in the Selenga River valley). Gen. distr.: Mong. Described from Mongolia. Type in Paris, cotype in Leningrad.

150 Genus 838. **MALACOCARPUS** * Fisch. et Mey.

Fisch. et Mey. in Ind. Sem. Petrop. IX (1843) 78; Engl. in E. P. Nat. Pflanzenfam. III, 4 (1897) 91, pro sect. gen. *Peganum*

Calyx 5-partite, persistent in fruit, with lobes recurved; petals 5; stamens 15, with filaments dilated below and 2-locular anthers, opening by longitudinal slit; style simple, edged-clavate above; fruit a fleshy 3-locular berry. Shrubs, with spreading branches and soft glabrous leaves dissected into linear lobes.

1. *M. crithmifolius* (Retz.) C.A.M. in Ind. Sem. Petrop. IX (1843) 79; Spisok rast. G.R.F. VIII (1922) 1. — *Peganum crithmifolium* Retz. Observ. bot. III (1783) 34; Ldb. Fl. Ross. I, 489; Boiss. Fl. or. I, 917. — *P. Harmala* β. DC. Prodr. II (1825) 712. — Ic.: Eichw. Pl. nov. casp.-cauc. (1883) tab. 15. — Exs.: G.R.F. No. 2402.

Shrub; profusely branching, with spreading thin branches up to 1 m long, yellow in cross section, covered with whitish bark, bark on old branches brownish-gray; stipules inconspicuous, lanceolate, sometimes incised; leaves up to 5 cm long, sessile, alternate, ovate, soft, glabrous, irregularly dissected into lanceolate-linear, often curved lobes, lobes sometimes incised. Flowers solitary on long branches, opposite to leaves; pedicels 1–1.5 cm long, thicker above; calyx lobes lanceolate, subequal, 4–6 mm long, ca. 2 mm wide, recurved in fruit; petals white, lanceolate, obtuse above, 10–12 mm long, 2.5–3.5 mm wide; style persistent, 5–7 mm long; berry brownish-red, globose, 6–10 mm in diameter; seeds dark brown, subovoid, ca. 2 mm long. Fl. April, Fr. June.

Rocks, rubbly slopes, gravel-silt deposits in foothills. — Centr. Asia: Ar.-Casp. (Ust-Urt), Kara K. (W.), Mtn. Turkm. (Greater and Lesser Balkhan Ranges, Kopet-Dagh, rarely; Zulfagar ravine). Gen. distr.: N. Iran. Description based on specimens grown from seeds from Mangyshlak Peninsula.

* From the Greek *malacos* and *carpos* — soft fruit.

Subfamily 2. **TETRADICLIDOIDEAE** Engl. in E. P. Pflanzenfam, III, 4 (1896) 355; Ibid. 19a (1931) 156. — Ovary 3–4-locular, cell divided by false septa into 3 compartments, the middle 3-ovuled, the lateral 1-ovuled; lower leaves opposite, the upper alternate.

151 Genus 839. **TETRADICLIS** * Stev.

Stev. in M. B. Fl. taur-cauc. III (1819) 277, 648. — *Anatropa* Ehrenb. in Linnaea, IV (1829) 402

Calyx with 3–4 teeth, persistent in fruit; corolla with 3–4 petals, also persistent; stamens the same number as petals and alternate to them; ovary 3–4-locular, flattened above, each cell divided by false septa into 3 compartments, the lateral 1-ovuled, the middle 3-ovuled; style with "decurrent" stigmas; capsule 3–4-celled, 3–4-lobed, flattened above, dehiscing by valves. Annual.

There is only one species in this genus.

1. *T. tenella* (Ehrenb.) Litw. in Tr. Bot. Muz. AN. III (1907) 122; Spisok rast. G. R. F. VI (1908) 151; Grossg., Fl. Kavk. III, 16; Kryl., Fl. Zap. Sib. VIII, 1851. — *Anatropa tenella* Ehrenb. in Linnaea, IV (1829) 402. — *Tetradiclis salsa* C. A. M. Verz. Pfl. Cauc. (1831) 226; Ldb. Fl. Ross. I, 492; Boiss. Fl. or. I, 918; Shmal'g., Fl. I, 189. — *T. Eversmanni* Bge. in Linnaea, XIV (1840) 178; Ldb. Fl. Ross. I, 493. — Ic.: Linnaea, XIV (1840) tab. I. — Exs.: G. R. F. No. 1973; Fl. cauc. exs. No. 70; Herb. Fl. Cauc. No. 34.

Annual; small delicate plant, with annual filiform root; stems 5–15 cm long, glabrous, simple or with few opposite, basal branches; leaves few, glabrous, somewhat fleshy, alternate, whorled on branches, incised or entire, linear-oblong to oblanceolate, obtuse, up to 10 mm long and 3 mm wide, with 1 or 2 auricles at base. Flowers small, terminal on branches forming racemiform inflorescence (nearly a cyme); pedicels not longer than 1 mm; calyx incised nearly to middle into 3–4 teeth; corolla white, with 4 petals, cuneate-tapering at base, up to 1 mm long, longer than calyx; capsules globose, obtusely lobed, flattened above, ca. 3 mm in diameter. Fl. April–May, Fr. May.

Moist solonchets and solonchaks in the desert and semidesert zones. — European part: L. V. (Caspian lowland, mainly), Crim. (N. Sivash); Caucasus: Cisc., E. Transc.; Centr. Asia: in all parts of the desert and semidesert plains. Gen. distr.: E. Med. (Syria, Palestine, Egypt), Iran. Described from N. Caucasus (Kama River near Gorki). Type in Helsinki, cotype in Leningrad.

152 Subfamily 3. **ZYGOPHYLLOIDEAE** Engl. in E. P. Pflanzenfam. III, 4 (1890) 78; ibid. 19a (1931) 158. — Herbs or shrubs, rarely annuals; leaves uniparous or multiparous, rarely simple.

* From the Greek *tetra* — four and *dicle* — a 2-valved door, thus named due to the structure of the fruit — a 4-lobed capsule dehiscing at the median sutures.

Genus 840. **ZYGOPHYLLUM** * L.**

L. Spec. pl. ed. 1 (1753) 385

Flowers 4–5-merous, solitary or twin, axillary; sepals 4–5, often quite unequal, sometimes deciduous; petals white, yellow, orange, sometimes with orange or red claw, rarely petals completely absent; stamens 8–10, with squamiform appendages at the inside base of filaments; ovary 3–4–5-locular; stigma simple; fruit a capsule, rarely baccate, globose to cylindrical, pentahedral, wingless, or narrowly or broadly winged with 3–4–5 wings; cells with 1 or few seeds; capsules with septa along middle of valves. Perennial herbs or shrubs, with simple or compound leaves; leaves opposite, with 2–10 leaflets; leaflets flat or terete, fleshy; stipules herbaceous or membranous.

The genus comprises about 100 species that are mainly distributed in the deserts of Africa, Palestine, Arabia, in the Mediterranean area, Central and Middle Asia, and Australia.

1. Petals absent; root thickened, funiliform 1. *Z. portulacoides* Cham.
- + Petals 4 or 5; root not fleshy 2.
2. Shrubs, with simple leaves covered with stellate hairs when young 38.
- + Shrubs or perennial herbs, leaves compound with 1–5 pairs of leaflets 3.
3. Annuals; capsules oval, with rather broad wings; leaflets 2 pairs 20. *Z. lehmannianum* Bge.
- + Perennial plants or shrubs; capsules linear to globose, wingless or winged; leaflets 1–5 pairs 4.
4. Shrubs; leaves with 1 pair of small leaflets; petioles longer, shorter or nearly as long as leaflets; capsules globose with 3 or 4 wings 5.
- + Perennial herbs; capsules cylindrical to oval-globose, winged, narrowly winged or wingless 8.
5. Fruit 3-winged, large, globose or oval, immarginate at apex; glabrous plants 6.
- 153 + Fruit 5-winged, deeply notched; young branches and stipules pubescent 33. *Z. bucharicum* B. Fedtsch.
6. Fruit globose; leaves oblong-spatulate or obovate, shorter than petioles (Fergana) 7.
- + Fruit oval, usually with persistent calyx; leaflets linear or linear-spatulate, nearly as long as or longer than petioles 32. *Z. kaschgaricum* Boriss.
7. Leaflets 3–7 mm long, 2–3 mm wide; petioles 4–8 mm long, thin; sepals orbicular-oval, ca. 5 mm long; capsules globose, on 7–10 mm long pedicels 31. *Z. ferganense* (Drob.) Boriss.
- + Leaflets up to 15 mm long, 5 mm wide; petioles up to 25 mm long; sepals 7 mm long, oval; capsules usually slightly broader than long, on (10)15–20 mm long pedicels 31. *Z. ferganense* subsp. *elongatum* Boriss.

* Treatment by A.G. Borisova.

** From the Greek – bean caper.

8. Fruit with broad conspicuous wings broader than seeds 9.
- + Fruit wingless or narrowly winged 13.
9. Capsules globose, oval or ovoid, with broad wings several times
broader than cells 10.
- + Capsules attenuate, oblong or cylindrical, obtuse or short-acute . . .
. 12.
10. Leaves with 1–2 pairs of large broad leaflets; glabrous plants
. 30. *Z. potaninii* Maxim.
- + Leaves with 2–5 pairs of lanceolate-oblong to orbicular small
leaflets; stems and petioles scabrous from small papilliform
excrecences or subglabrous 11.
11. Leaflets lanceolate or oblong-lanceolate, 2–3(4) pairs; capsules
oval, tapering at base; flowers 10–11 mm long, yellowish (C. and
E. Tien Shan) 28. *Z. kegensense* Boriss.
- + Leaflets elliptic or obovate, 3–5 pairs; capsules usually globose or
oval-globose; flowers 7–9 mm long, white 29. *Z. macropterum* C. A. M.
12. Leaflets 2–3 pairs, linear-oblong or lanceolate, acute, 5–13(15) mm
long, 1.5–3(5) mm wide; pedicels 5–10 mm long, later elongating;
capsules oblong-oval or oval, 10–20 mm long, 6–10(12) mm wide;
seeds 3–4 mm long, 1.5–2.5 mm wide 22. *Z. pterocarpum* Bge.
- + Leaflets 2 pairs, flat, broadly ovate, unequal-sided, obtuse, 8–12 mm
long, 5–9 mm wide; pedicels short, 2–4 mm long; capsules oblong,
2.5–3 cm long, 10–14 mm wide; seeds large, ca. 6 mm long, 3 mm
wide 23. *Z. taldy-kurgenicum* Boriss.
- 154 13. Capsules with very narrow wings; leaflets 2–4 pairs, oblong-oval to
linear-spatulate 14.
- + Capsules wingless, sometimes with acute ribs, globose to lanceolate-
attenuate; leaflets 1 or 1–4 pairs, flat, orbicular or ovate or oblong
to linear-lanceolate 17.
14. Capsules lanceolate or oblong, acuminate 15.
- + Capsules ovoid, obtuse at apex, 10–18 mm long, ca. 8 mm wide in the
broadest part. (Kara-Tau Range) 19. *Z. karatavicum* Boriss.
15. Plant 5–6 cm high; leaflets 2–3 pairs, oblong or oblong-lanceolate;
seeds smooth. (Dzharkent district) 18. *Z. cuspidatum* Boriss.
- + Plant 10–15 cm high, leaflets or seeds not as above 16.
16. Leaflets 2–3 pairs, linear-spatulate, up to 8–20 mm long, 1–2.5 mm
wide; sepals oblong-ovate, 6–7 mm long, 2.5–3 mm wide. (Zaisan
depression) 16. *Z. oxycarpum* M. Pop.
- + Leaflets (2)3–4 pairs, oblong to oblong-oval, 5–8 mm long, 2–3 mm
wide; sepals ca. 8 mm long, ca. 2 mm wide. (Kopal district)
. 17. *Z. kopalense* Boriss.
17. Leaflets always 1 pair 18.
- + Leaflets 1–4 pairs 32.
18. Leaflets oblong to linear-lanceolate; fruit attenuate or globose
. 29.
- + Leaflets flat, broad, ovate or orbicular, if leaflets attenuate then
capsules cylindrical 19.

19. Low caespitose plants, 10–20 cm high, with short internodes and robust multicapitate root; capsules 10–30 mm long, obtusely pentahedral, linear-lanceolate, slightly curved 20.
+ Plants with developed stems, (20)30–60(100) cm high, with long internodes; capsules globose to oblong or linear 22.
20. Capsules 7–15(20) mm long, ca. 5–6 mm wide above, ovoid or oblong- or lanceolate-oblong. (North of Lake Balkhash) 10. *Z. microcarpum* Boriss.
+ Capsules 18–25 mm long and 3–4 mm wide or 30–50 mm long and 5–7 mm wide 21.
21. Leaflets large, 1.5–2.5 cm long, always obtuse or rounded at apex; petioles ending with ovate scarious appendage; flowers mostly solitary, axillary; capsules 3–5 cm long, 5–7 mm wide. (Lake Balkhash area) 9. *Z. latifolium* Schrenk.
+ Leaflets (5)8–15 mm long, 7–12 mm wide, ovate, unequal-sided, often acute at apex, rarely rounded; petioles terminated by short lanceolate, later deciduous appendage; flowers 2, rarely 1, axillary; capsules 18–25 mm long, 3–4 mm wide. (Tien Shan, Pamir-Alai, Dzungaria-Tarbagatai) 8. *Z. rosovii* Bge.
22. Stems lignified, pale yellow below; capsules subglobose, ca. 10 mm long, with acute-winged ribs/edges. (Sands in Ili River valley, sands of Muyun-Kum) 24. *Z. fabagoides* M. Pop.
+ Herbaceous plants, sometimes a little woody at base; capsules long-cylindrical or short-oval to ovoid, with obtuse edges 23.
23. Stamens not exserted; leaflets glaucous, cuneate at base, unequal-sided, acute at apex; capsules 30–40 mm long, erect; plants usually prostrate or ascending, 15–30 cm high 5. *Z. obliquum* M. Pop.
+ Stamens longer than petals; leaflets green, orbicular, obovate or oblong, rounded-obtuse at apex; capsules 10–30(40) mm long, drooping or erect; erect plants 24.
24. Stems many, thin, branching from base, 25–30 cm high; leaflets oblong or lanceolate, obtuse; fruits declinate, cylindrical, ca. 10–18 mm long, on 1.5–2.5 cm long pedicels. (Zaisan depression, Altai) 6. *Z. brachypterum* Kar. et Kir.
+ Stems usually robust, 30–60(100) cm high; leaflets large, unequal-sided, orbicular, ovate or oblong-ovate; fruits erect or declinate, oblong to long-cylindrical, (10)15–40 mm long 25.
25. Capsules long, cylindrical, (2.5)3–4 cm long, disposed along entire length of stem, erect or declinate; robust plants, with large leaflets, few stems, few branches 26.
+ Capsules 1–2 cm long, ovoid or oblong-ovoid, often broadening above, disposed in the upper part of stem, the upper erect; multicaulescent branching plants; seeds smooth, with uninterrupted gray coating; petals with orbicular limb 3. *Z. oxianum* Boriss.
26. Fruit erect, equal-margined, cylindrical-pentahedral, large, (2.5)3–3.8 cm long; seeds smooth, shiny, with spongy gray coating; petals ca. 10 mm long; stamens more or less distinctly exserted. (E. Kazakhstan: Dzsharkent district, Kopal district) 4. *Z. macropodium* Boriss.
+ Fruit drooping or declinate, long-cylindrical or short, (10)15–20 mm long 28.

27. Fruit long-cylindrical, 20–40 mm long, drooping 28.
+ Fruit short, 10–15 mm long, ovoid or oblong-ovoid. (East of the
156 Amu Darya River) 2. *Z. fabago* L. subsp. *orientale* Boriss.
28. Flowers ca. 6–8 mm long. (Crimea, Caucasus, Kopet Dagh Range,
eastern shores of the Caspian Sea)
. 2. *Z. fabago* L. subsp. *typicum* M. Pop.
+ Flowers ca. 10 mm long. (Kuldja, Khorgos, Ili River).
. 2. *Z. fabago* subsp. *polichocarpum* M. Pop.
29. Smooth glabrous plants; fruit globose or ovoid 30.
+ Plants scabrous-short-papillate; fruit attenuate, acute; leaflets
indistinctly jointed with the short petiole, furcately spreading
. 15. *Z. furcatum* C. A. M.
30. Leaflets conspicuously adnate to the much narrower petiole 31.
+ Leaflets inconspicuously jointed with petiole, furcately spreading;
petiole short, as wide as leaflets. (Near Dzhambul and Lake Balkhash)
. 27. *Z. stenopterum* Schrenk.
31. Semishrubs up to 1 m high; capsules small, ovoid or globose-ovoid,
acutely pentahedral, 6–9 mm long, 7–8 mm wide; flowers ca. 6 mm
long, nearly regular; petals nearly as long as sepals; leaflets mostly
linear to subfiliform. (W. Turkmenistan, Kyzyl-Kum)
. 25. *Z. eichwaldii* C. A. M.
+ Herbaceous perennials; capsules elliptic, 10–15 mm long, 9–11 wide;
flowers irregular, 8–11 mm long; petals longer than sepals; leaflets
lanceolate to oblong-elliptic. (Caspian Sea from Kara-Bugaz gulf
to Gurev and Inder Lake, Ust-Urt)
. 26. *Z. ovigerum* Fisch. et Mey.
32. Leaflets broadly oval or orbicular, flat; stipules scarious; capsules
oval, oblong-cylindrical or linear 33.
+ Leaflets oblong to linear, usually thick; stipules herbaceous, scarious
at margin or scarious; capsules linear, if oblong-oval to globose
then stipules herbaceous, with scarious margin 35.
33. Plant scabrous with long papilliform hairs, low, 3–10 cm high; stamens
shorter than calyx. (Altai) 39. *Z. melongena* Bge.
+ Glabrous plant, 10–40 cm high; stamens exserted from flower
. 34.
34. Capsules oblong or oblong-oval, up to 2 cm long, 6 mm wide, erect;
plant 5–15(20) cm high. (Ili River valley and foothills)
. 21. *Z. iliense* M. Pop.
+ Capsules linear, usually falcately curved, 3–4 cm long, 3–5 mm wide;
plant 10–20(35) cm high. (Kyzyl Kum, Kara-Kum)
. 7. *Z. miniatum* Cham. et Schlecht.
35. Petioles usually longer than leaflets; leaves with 1 or 2–3 pairs of
leaflets; capsules linear-lanceolate or linear, acute 36.
157 + Petioles usually shorter than leaflets; leaves with 3, rarely 2–4 pairs
of leaflets; capsules oblong-cylindrical to globose, obtuse 37.
36. Leaflets 1, rarely 2 pairs, narrow, linear or linear-spatulate, broader
at apex than petiole, 5–15 mm long, 1–2 mm wide; plants 10–25 cm
high 11. *Z. turcomanicum* Fisch. et Mey.
+ Leaflets 1–3 pairs, oblong or lanceolate-oblong, the upper linear,
1–2 pairs, 10–15(30) mm long, 2–4(6) mm wide; plants 20–40 cm
high 12. *Z. dielsianum* M. Pop.

37. Stems erect; leaflets mostly 3-4-pairs, linear or oblong-lanceolate, acute; pedicels not longer than flowers; capsules globose-oval, 8-10 mm wide 14. *Z. balchaschense* Boriss.
 + Stems spreading; leaflets 2-3 pairs, lanceolate-oblong to oblong-ovate; pedicels much longer than flowers; capsules oblong-cylindrical to oblong-oval, 4-5 mm wide 13. *Z. subtrijugum* C. A. M.
38. Fruit a 4-winged capsule; petals and sepals 4 39.
 + Fruit a 5-winged capsule; petals and sepals 5 40.
39. Capsules broader (2.5-3.5 cm) than long (1.5(2-3)), distinctly notched above and below; wings 3-4 times broader than seeds; seeds 2-3 in cell; leaves elongate, usually oblong. (Iran, Afghanistan, SE Turkmenistan, SW Uzbekistan) 34. *Z. eurypterum* Boiss.
 + Fruit nearly as broad (2-2.5 cm) as long (2-2.3 cm), more or less globose, slightly notched; wings 1.5-2 as broad as seeds; seeds usually 1 in each cell; leaves orbicular, with 3-7(10) mm long petioles. (S. Tadzhikistan, from Babatag Range to Darvaza) 35. *Z. gontscharovii* Boriss.
40. Flowers white; pedicels short, 3-5 mm long, densely hairy, erect above, elongating in fruit up to 12-20 mm; branches virgate, long. (Darvaza) 36. *Z. darvasicum* Boriss.
 + Flowers yellow or white; pedicels 5-15 mm long, if pubescent then not densely so, usually drooping in fruit; rough branching shrubs 41.
41. Fruit 1.5-2(2.5) cm wide, 1-3-2(2.5) cm long; wings 1.5-2 times as broad as cell; flowers white; shrubs 50-120 cm high. (Caucasus, mountainous part of Turkmenistan) 37. *Z. atriplicoides* Fisch.
 + Fruit large, 3-4 cm wide, 3.5-4.5 cm long, on short thick pedicels, wings shiny, 3 times as broad as cell; flowers yellow; tall shrub, 2-2.5 m; leaves large, acute, with petioles as long as blade. (E. Fergana, Alai, Turkestan and Zeravshan ranges) 38. *Z. megacarpum* Boriss.

Subgenus 1. *Miltianthus* (Bge.) Boriss. — Gen. *Miltianthus* Bge. in Arbeit Naturwiss. Vereins zu Riga, I (1847) 197; Icon. pl. nov. Lehm. I (1848) 58. — Calyx deciduous; 2 sepals petaloid; petals absent; seeds with gray coating of a vertical fibrous structure, separated by slits; leaves usually with 2 pairs of leaflets; root thick, fleshy, similar to the root of *Eremurus*. Central Asia, Afghanistan.

1. *Z. portulacoides* Cham. in Linnaea, V (1830) 50; M. Pop. in Byull. S. A. G. U. 11 (1925) 111. — *Miltianthus portulacoides* Bge. in Mém. sav. étrang. VI (1851) 234; Boiss. Fl. or. I, 916; O. and B. Fedch., Perech. r. Turk. I, 155. — *Zygophyllum macrophyllum* Rgl. et Shmal'g. in Izv. Obshch. Lyub. Estestv. Antrop. i Etnogr. XXXIV, No. 2 (1882) 16; O. and B. Fedch., ibid. — Ic.: Bge. in Arbeit. Naturwiss. Verein zu Riga (1848) tab. 9; M. Pop. l. c. tab. 4 (1) f. 1.

Perennial herb; root robust, elongate, with fleshy cordlike 1–2 cm long thick branches; stems, fleshy, glabrous, furcately branching; stipules free, large, 5–6 mm long, broadly scarious at margin, suborbicular or ovate, obtuse; leaves nearly as long as internodes, with fleshy petioles ca. 5–8 mm long, with 2, rarely 1 or 3 pairs of leaflets; leaflets ovate, obtuse, 3–5-nerved, 15–25(40) mm long, 8–15(24) mm wide. Peduncles thickened above; flowers paired, axillary, 5-merous; calyx deciduous, 7–8 mm long; 3 of 5 sepals broadly ovate, obtuse, narrowly membranous at margin, the other 2 petaloid; petals absent; stamens longer than calyx, 12–15 mm long; staminal scales lanceolate, fimbriate, ca. 3 mm long, adnate at base to filament; styles filiform, nearly as long as stamens; ovary glabrous; fruit a capsule 2.5–4.5 cm long, 10–15 mm wide, elongate-oblong, pentagonal; obtuse; seeds up to 9 mm long, covered with gray, thick and indurate coating, sectioned by slits due to vertical fibrous structure. Fl. March–May, Fr. April–July.

Sandy, rubbly and clayey slopes, loose sands, clayey-gravelly deserts, conglomerate ridges and barren stony plains, at solonchaks. — Centr. Asia: Kyz. K., Amu D. (Chaur, Leninabad), Syr D. (Kokand, Mogol-Tau Mountain). Gen. distr.: Afghanistan. Described from Bukhara. Type in Leningrad.

Subgenus 2. *Fabago* (Adans.) M. Pop. in Byull. S. A. G. U. 11 (1925) 105. — Gen. *Fabago* Adans. Fam. d. Plant II (1763) 507; sect. *Fabago* 159 Endlich. Gen. plant. (1836–1840) 1164; Engler in Engl. u. Prantl, Natürl. Pflanzenfam. 19, a (1931) 161. — Flowers always 5-merous; calyx late deciduous, but sometimes persistent; fruit a pentagonal or pentapterous, many-seeded, dehiscent capsule; perennial herbs, sometimes becoming woody at base, rarely annuals; leaves with 1 or many pairs of leaflets; root not fleshy; mainly Central and Middle Asian plants except for *Z. fabago* L. distributed also in S. Europe and Africa.

Section 1. EUFABAGO M. Pop. in Byull. S. A. G. U. -11 (1925) 105, p. p. — Capsules obscurely winged or wingless, cylindrical to oblong-oval; leaflets 1–4 pairs; herbaceous perennials, sometimes becoming woody at base. — S. Europe, Central Asia.

Series 1. *Macrophylla* Boriss. — Capsules wingless, long-cylindrical to oblong-cylindrical; leaves with 2 usually large, unequal-sided flat leaflets; stipules herbaceous, large.

2. *Z. fabago* L. Sp. pl. (1753) 385; DC. Prodr. I, 705, p. p.; Ldb. Fl. alt. II, 105, p. p.; Ej. Fl. Ross. I, 485, p. p.; Kryl., Fl. Zap. Sib. VIII, 1844; M. B. Fl. taur.-cauc. I, 310; Fisch. Zygophyll. 10; Boiss. Fl. or. I, 913; Shmal'g., Fl. I, 186; O. and B. Fedch., Konsp. Fl. Turk. I, 153, p. p.; M. Pop. in Byull. S. A. G. U. 11 (1925) 112; Grossg., Fl. Kavk. III, 17. — *Z. fabago* var. *brachypterum* M. Pop. l. c. p. p. — Ic.: Baill. Hist. de Plant, IV, 416; M. Pop. l. c. tab. 4 (1) f. 2-a. — Exs.: H. F. A. M. No. 186 (var.); G. R. F. No. 1762; Fl. cauc. exs. No. 3112; Fl. pol. exs. No. 810, 516.

160 Perennial herb; root more or less thick; smooth plant, with erect or slightly ascending stems, 30–60(80) cm long, sometimes becoming woody at base, branches more or less spreading; stipules 4–10 mm long, herbaceous, green, deciduous, ovate or elliptic, connate at lower and median leaves, upper leaves free, smaller, lanceolate, entire; leaves with 1 pair of thick leaflets; petioles 1–1.5 cm long, ending with a small lanceolate or linear appendage; leaflets broad, green, obovate, sometimes oblong-obovate, asymmetrical, rounded or acute at apex (specimens from the Crimea and the S. European part of the USSR), 15–33 mm long, 6–20 mm wide. Flowers on 4–10 mm long pedicels; sepals ovate or elliptic, obtuse, white-membranous at margin, 5–7 mm long, 3.5–4.5 mm wide; petals nearly as long as sepals, obovate, usually uneven at apex, whitish, orange in lower part like stamens and staminal scales; stamens longer than petals, 11–12 mm long; anthers ovate, large; staminal scales linear-oblong, three-fourths as long as filaments, crenate or lacinate at apex; capsules drooping, straight, (2)2.5–3.5 cm long, 4–5 mm wide, oblong-cylindrical, wingless, pentahedral, obtusely angled, many-seeded. Fl. April–June, Fr. June–September.

Solonchaks, sandy hills, steppe deserts, as a roadside weed and in waste places. — European part: Bl., Crim., L. Don, L. V.; Caucasus: Cisc., Dag., W., E. and S. Transc., Tal.; Centr. Asia: Ar.-Casp., Kara K., Mtn. Turkm. Gen. distr.: Med. (Spain, Syria, N. Africa), Bal.-As. Min. (Asia Minor), Arm.-Kurd., Iran., Mesopotamia. Described from Syria. Type in London.

1. Subsp. *typicum* M. Pop. — Fruit recurved, long, cylindrical; flowers ca. 6–8 mm long (Crimea, S. European part of the USSR, Caucasus, Kopet-Dagh, eastern shores of the Caspian Sea). (Plate IX, Figure 5.)

2. Subsp. *orientale* Boriss. — Fruit short, 10–15 mm long, ovoid or oblong-ovoid. — Centr. Asia (east of the Amu-Darya River).

3. Subsp. *dolichocarpum* M. Pop. differs from the subsp. *typicum* M. Pop. by a more robust habit, larger leaves and longer fruits (Kuldja, Ili River, Khorgos).

Note. *Z. fabago* s. lat. varies throughout its extensive distribution area in a definite pattern that justifies the separation of a number of geographical races distinguished from each other morphologically. *Z. macropodum* Boriss. is a good species which occurs in Kazakhstan (Dzharkent district, Ili River valley and depression of Lake Ala-Kul) where it is confined to saline soils in foothills. It has been partly mixed with *Z. obliquum* M. Pop. from which it differs by the obtuse leaves, the size of the plant, the dimensions of flowers and fruits, and also by the character of its habitat and geography. Another good species, *Z. brachypterum* K. et K., which Popov misinterpreted as the widespread var. *brachypterum* M. Pop., occurs in the Zaisan depression and the adjacent parts of Altai. *Z. oxianum* Boriss., distinguished by abundant, short, upright fruits, grows in Merv district in the delta of the Amu Darya River in Samarkand, from the south to the Bakhsh River valley. *Z. fabago* subsp. *orientale* Boriss., with its short but less abundant, declinate fruits, is found elsewhere in E. Central Asia.

Of interest is subsp. *dolichocarpum* M. Pop. which grows along the border with China and in Kuldja. Morphologically, it differs very little from *Z. fabago* subsp. *typicum*, the western race. A form with acute leaflets is found in the Crimea and near Odessa.

Z. fabago also grows as a weed in Poland (in the former Lublin province near Sandomierz).

3. *Z. oxianum* Boriss. sp. nova in Addenda XIII, 723. — *Z. fabago* auct. non L.

- 161 Perennial; root robust, vertical, woody; stems 30–50 cm high, few, 1–3(5), erect, herbaceous, branching mostly above, densely striate; branches more or less appressed to stem, slightly curved, internodes 5–6 cm long; stipules large, (4)5–7 mm long, herbaceous, ovate, obtuse; lower leaves large, with petioles shorter than blade and terminating in short soft filiform mucro; leaflets of lower leaves large, asymmetrical, obliquely ovate or orbicular, 2.5–4 cm long, 1.5–3.5 cm wide, obtuse, usually remote, leaflets of upper leaves much smaller. Pedicels ca. 10–12 mm long; flowers and fruits disposed in upper part of stem, generally longer than leaves, usually 1–2, axillary, all erect; calyx with 5 sepals, three oval, 8 mm long, 4–5 mm wide, broad-membranous at margin, the other two 6 mm long, 4 mm wide, ovate, narrowly membranous at margin; petals white, orange from base up above the middle, ca. 10 mm long, 3 mm wide, oblong, rounded at apex; stamens 10, orange, 10–12 mm long, with large oblong anthers; staminal scales ca. 4 mm long, oblong-lanceolate, fimbriate at margin and apex, papillate at surface; ovary ovoid, with erect filiform style nearly twice as long as ovary; receptacle oblique; fruits many, cylindrical [sic? cf. key], slightly tapering at base, 1.5–2(2.5) cm long, 5–7 mm wide, 5-locular, with 5 acute ribs and 5 concave grooves; seeds numerous, ca. 2.5 mm long, ca. 2 mm wide, orbicular-ovate, smooth, gray. Fl. March–April, Fr. May–August. (Plate IX, Figure 6).

Clayey, solonchak and solonchak soils, sometimes on sands. — Centr. Asia: Kyz. K. (delta of Amu Darya River), Ar.-Casp., Syr D. (Namangan and Kokan districts), Kara K. (Mary, Tedzhen, Iolatan, Farab, Chardzhui, Sary-Yazy Stantsiya), Pam.-Al. (Pyandzh River near the Vakhsh River estuary). Endemic. Described from the environs of Iolatan Stantsiya in the Turkmen SSR. Type in Leningrad.

Note. *Z. oxianum* differs from *Z. fabago* s. str. by the shape and disposition of the fruits. The fruits of *Z. fabago*, the western race, are drooping and cylindrical whereas in *Z. oxianum* they are numerous, erect, pyriform-oblong, disposed mostly in the upper part of stem, its leaflets are orbicular and large.

4. *Z. macropodium* Boriss. sp. nova in Addenda XIII, 724. — *Z. fabago* auct. non L. — *Z. obliquum* M. Pop. in Byull. S. A. G. U. 11 (1925) 113, p. p.

Perennial; root robust, woody, vertical; stems (40)50–80 cm high, 1–5, erect, herbaceous, finely and densely striate, with few furcately spreading branches and long internodes; stipules small, herbaceous, acute; leaves with 1 pair of large thick leaflets; petioles narrowly winged, half as long as leaves, terminating in short linear mucro; leaflets oblong or obliquely

162 orbicular-ovate, remote, rounded at apex, 3–4 cm long, 1.5–3 cm wide. Pedicels short, 5–10 mm long; flowers in 2's, more or less regularly disposed along stem; calyx of 5 sepals, three broadly ovate, ca. 8 mm long, 5 mm wide, broadly white-membranous at margin, the other two sepals green, 8 mm long, 3 mm wide, ovate; petals white, 10 mm long, 5 mm wide, 3 petals emarginate, oblong, gradually tapering towards base; stamens 10, five 12 mm long, the others 14 mm, with oval anthers; staminal scales half as long as or slightly longer than filaments, linear, fimbriate at apex; ovary oblong, 5-locular, with erect filiform style twice as long as ovary; receptacle oblique; capsules cylindrical, pentahedral, wingless, (2.5)3–3.8 cm long, ca. 7 mm in diameter, obtuse at both ends, immature capsules linear with short persistent curved style; seeds many, ca. 10 in each cell, ovate, ca. 3 mm long, 2 mm wide, with shiny, spongy surface. Fl. May, Fr. July–August.

Sandy and clayey, saline soils, *Lasiagrostis splendens* stands, solonchaks, saltwort deserts, sandy hills. – Centr. Asia: Balkh. (Kopal district, Ala-Kul Lake, Ili River), Dzu.-Tarb. (Dzungarian Ala-Tau). Gen. distr.: Dzu.-Kash. (Kuldja). Described from Dzharkent district between the Ili crossing and Borokhudzir. Type in Leningrad.

5. *Z. obliquum* M. Pop. in Byull. S. A. G. U. 11 (1925) 113, p. p. – Ic.: Popov, l. c. tab. 4 (1) fig. 4.

Perennial; root thick, robust, multicapital; stems herbaceous, many, branching from base, ascending or decumbent, up to 30 cm long; stipules herbaceous, the lower connate, broadly ovate, obtuse, ca. 3 mm long, narrowly membranous at margin, the upper free, lanceolate or oblong, obtuse; leaves uniparous; petioles shorter than blade, flat, winged, with short linear-subulate, usually herbaceous mucro at apex; leaflets glaucous, asymmetrical, obliquely ovate, acute, mucronulate, 10–20 mm long, 7–10 mm wide, cuneate at base, jointed at petiole. Pedicels 1.5–2.5 times as long as flowers; flowers 10–18 mm long, solitary or twin; sepals ovate or oblong, 165 obtuse, green, very narrowly membranous at margin, 5–8 mm long; petals hardly longer than sepals, 6–10 mm long, obovate, orange below up to the middle; stamens not exerted from flower; staminal scales oblong, denticulate at margin and apex, three-fourths as long as filaments; capsules erect, oblong-cylindrical, ca. 3 cm long, ca. 5 mm wide, equal throughout, pentagonal-prismatic, obtuse at both ends; seeds ovate, 3 mm long, 2.5 mm wide, flattened, covered with small gray papillae. Fl. June–August, Fr. June–September.

Clayey, solonchak soils, sandy hills, wormwood-feather grass plots, gravel deposits, on old moraines up to 4,200 m, up to the alpine tundra and glaciers. – Centr. Asia: T. Sh. (Lake Issyk-Kul, Kegen River, Sary-dzhas), Pam.-Al. (Kyzyl-Su River, Pamir). Gen. distr.: Dzu.-Kash. (Kashgariya). Described from Pamir. Type in Leningrad.

6. *Z. brachypterum* Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 397; Ldb. Fl. Ross. I, 485; O. and B. Fedch., Perech. r. Turk. I, 155, p. p.; Kryl., Fl. Zap. Sib. VIII, 1845, p. p. – *Z. fabago* ssp. *brachypterum* M. Pop. in Byull. S. A. G. U. 11 (1925) 112, p. p. – *Z. fabago* Kryl., Fl. Alt. 203, non L.; Kryl., Fl. Zap. Sib. VIII, 1845, p. p. – Ic.: M. Pop. l. c. tab. 4 (1), f. 2-b.



PLATE IX. 1—*Zygophyllum stenopterum* Schrenk.; 2—*Z. ovigerum* Fisch. et Mey.; 3—*Z. eichwaldii* C.A.M.; 4—*Z. miniatum* Cham. et Schlecht.; 5—*Z. fabago* var. *typicum* M. Pop.; 6—*Z. oxianum* Boriss.

Perennial; root thick, woody, multicipital; stems 6–10, erect, slightly flexuose, branching, herbaceous, thin, 15–30 cm high, with short 3–4 cm long internodes; stipules large, 3–5 mm long, ovate, obtuse; leaves with 1 pair of leaflets, rachis ending with a short-filiform mucro; petioles three-fourths as long as leaves, winged; leaflets obtuse, oblong to lanceolate, (1)1.5–2.5 cm long, (3)5–6(8) mm wide. Flowers on long, thin, up to 1.5–2.5 cm long pedicels; sepals unequal, three ca. 9 mm long, 4 mm wide, broadly membranous at margin, oblong-ovate, slightly emarginate, two sepals oval, ca. 7 mm long, 3 mm wide, obtuse; petals orbicular-oval, obtuse at apex, unequal, two 5 mm long, three 4 mm long, all short-clawed; stamens 10, five stamens 8 mm long; staminal scales (appendages of filaments) deeply fimbriate-incised, linear-lanceolate, more than half as long as filaments; ovary oblong, with thin style curved at apex; receptacle oblique; capsules pendulous downwards or to one side, long-pedicel, short-cylindrical, 10–18 mm long, ca. 5 mm wide, pentahedral, wingless, obtuse, with short persistent style; seeds 3 mm long, 1.5–2 mm wide, subreniform, fissured at surface, tuberculate with protruding papillae. Fl. May–June, Fr. July.

166 Clayey-solonchak soil, often in *Lasiagrostis splendens* stands. — W. Siberia: Alt. (S.); Centr. Asia: Balkh. (near Lake Zaisan, Irtysh River). **Gen. distr.:** Dzu.-Kash. Described from Lake Zaisan. Type in Leningrad.

Note. *Z. brachypterum* Kar. et Kir. is a good species with a definite distribution area that is smaller than that proposed by some authors, being limited to S. Altai, Zaisan depression and the adjacent parts of China. Its typical features are: numerous thin, low stems; long flowers; short, pendulous, cylindrical fruits; all of which clearly distinguish it from the other species in the series *Macrophyllae* Boriss.

Series 2. *Miniata* Boriss. — Capsules wingless, linear; leaves with 1–3(4) pairs of flat leaflets; stipules membranous, small.

7. *Z. miniatum* Cham. et Schlecht. in *Linnaea*, V (1830) 49; Ldb. Fl. Ross. I, 485 (in observ.); Bge. Rel. Lehm. 237; Boiss. Fl. or. I, 912; O. and B. Fedch., Perech. r. Turk. I, 154; M. Pop. in Byull. S. A. G. U. II (1925) 120. — *Z. cinnabarinum* Freyn. in herb. — Ic.: Pop. l. c. tab. 5 (2), f. 13a. — Exs.: G. R. F. No. 1857; H. F. A. M. No. 188.

Perennial; glabrous plant; stems herbaceous, prostrate to ascending, furcately branching, whitish, sulcate; stipules membranous, the upper elongate, lanceolate to linear, acuminate, 3–4 mm long; leaves with 1–3(4) pairs of broadly oval [obovate] leaflets, the upper often with 1 pair of leaflets; petioles 7–15 mm long, slightly broadening near axis of leaf; leaflets broadly obovate, obtuse, 5–12 mm long, 3–8 mm wide, sometimes up to 2 cm long, 13 mm wide (var. *cinnabarinum* Fr. et Sint.). Pedicels shorter than calyx; flowers twin, axillary; sepals oblong-elliptic, obtuse, white-membranous at margin, 7–9 mm long; petals white, with red cuneate claw, ca. 8 mm long, 3 mm wide in upper part; stamens exserted from flowers, five stamens ca. 12 mm long, five ca. 8 mm; staminal scales linear, shallowly fimbriate above, like stamens bright red; capsules drooping, linear, 30–40 mm long, 3–5 mm wide, wingless, falcately curved; seeds oblong-lanceolate, 4–5 mm long, ca. 1.5 mm wide, tuberculate. Fl. April–May, Fr. May. (Plate IX, Figure 4.)

Sands, gypsiferous and clayey-gravelly desert soils. — Centr. Asia: Ar.-Casp., Kyz. K., Kara K., Pam.-Al. Endemic. Described from Bukhara (near Agatme). Type in Leningrad.

Note. Var. *cinnabarinum*, cited in Bull. Herb. Boiss. IV (1904) 35 var. *cinnabarinum* Fr. et Sint. = var. *englerianum* M. Pop. in Byull. S. A. G. U. II (1925) 121, differs from the typical form by a taller habit (up to 35 cm), larger leaves and leaflets, and narrower petals (Ashkhabad, Kelif, Kul-Keriz in Khodzhent district).

- 167 8. *Z. rosovii* Bge. in Linnaea, XVII (1843) 5; Bge. in Rel. Lehm. 536; Maxim. Enum. pl. Mong. 125; O. and B. Fedch., Perech. r. Turk. I, 153; Kryl., Fl. Za. Sib. VIII, 1845; M. Pop. in Byull. S. A. G. U. II, 117. — Ic.: M. Pop. l. c. tab. 5 (2) fig. 10a.

Perennial; root woody, robust, multicipital, with smooth reddish bark; stems many, usually spreading, sulcate, glabrous, 10–15 cm high; stipules all free, white-scarious, ovate, the upper acuminate, finely crenate at apex, the lower obtuse, 2–3 mm long; leaves on 2–7 mm long petioles terminating in small white scarious lanceolate mucro, later deciduous; leaflets 1 pair, ovate, unequal-sided, acute or rounded at apex, 8–15(25) mm long, 7–12 cm wide, glaucous-green (like stems). Flowers usually 1–2, axillary, on 5–7 mm long pedicels, at first erect, drooping in fruit; sepals elliptic, obtuse, scarious at margin, ca. 5 mm long, 2–3 mm wide; petals 5–7 mm long, 2–2.5 mm wide, obovate, orange-red, whitish at the rounded apex, cuneate at base; stamens orange; staminal scales oblong, crenate or entire at apex; capsules 18–25 mm long, ca. 4 mm wide, linear-lanceolate, thinly acuminate, dehiscing when ripe, obtusely pentahedral, subcylindrical, slightly or fal-cately curved; seeds oblong-ovate, acuminate, glaucous, finely dotted at surface. Fl. May–July, Fr. June–August.

Stony slopes, cliffs, up to 4,100 m in Pamir, pebbly and stony semideserts, sandy and solonchetic soil, pebbly-clayey and gravelly places, older Tertiary deposits. — Centr. Asia: Dzu.-Tarb., T. Sh. (Lake Issyk-Kul, Almatinka River); Pam.-Al. (Alai valley, Pamir). Gen. distr.: Dzu.-Kash., Mong., Tib. Described from Mongolia. Type in Paris.

9. *Z. latifolium* Schrenk in Bull. Phys.-Math. Acad. St. Pétersb. II (1844) 198; Bge. in Rel. Lehm. 536; Trautv. in Bull. Soc. Nat. Mosc. XXXIII (1860) 464; Fisch. et Mey. in Suppl. Ind. IX, Sem. hort. Petr. 22. — Ic.: M. Pop. in Byull. S. A. G. U. II (1925) tab. 2 (5) f. 10b [*Z. Rosovii* var. *latifolium* (Schrenk) M. Pop.]

Perennial; resembling *Z. rosovii* Bge., but differing by larger stature, 15–20 cm high; leaflets large, suborbicular, 1.5–2.5 cm long, obtuse at apex; petioles mostly with ovate scarious mucro. Flowers generally 1 in axil; petals nearly as long as calyx; staminal scales usually entire; capsules large, cylindrical, curved, 3–5 cm long, 5–7 mm wide. Fl. April, Fr. May–June.

- 168 Sandy and solonchetic soils, pebbly and stony semideserts. — Centr. Asia: Balkh. (Sary-Su river, Kara-Kingir, Lake Balkhash, Ili River, Lake Zaisan shores of Chernyi Irtysh). Endemic. Described from Kara-Kingir. Type in Leningrad.

Note. The many differentiating characters, the isolated distribution area and the specific ecological conditions make it possible to distinguish *Z. latifolium* Schrenk as a separate species albeit closely related to *Z. rosovii* Bge.

10. *Z. microcarpum* Boriss. sp. n. in Addenda XIII, 724.

Perennial; root robust, woody, multicapital; stems ca. 15 cm high, brittle, sulcate; stipules white-membranous, triangular, small, nearly entire or hardly crenate; leaves with short, 3–4 mm long petioles and 2 asymmetrical orbicular-ovate obtuse leaflets 6–12 mm long, 5–8 mm wide. Flowers 1–2 in axil, on ca. 3 mm long pedicels; sepals 5, oblong, ca. 7 mm long, 3 mm wide; petals white in the upper part, otherwise orange, orbicular, with short cuneate claw, hardly emarginate, ca. 6 mm long, 4 mm wide; stamens orange, exerted from flower, ca. 10 mm long; staminal scales 4 mm long, lanceolate, fimbriate at apex; capsules 7–15(20) mm long, 5–6 mm wide in upper part, ovoid, oblong or lanceolate-oblong, acuminate-tapering, pentahedral, slightly curved; ripe capsules with valves dehiscing in an umbellike form; seeds 3–4 mm long, ca. 1 mm wide, oblong-lanceolate, acuminate at one end, surface uninterruptedly covered with papillae. Fl. May–June, Fr. June–July.

Gypsum outcrops and porphyric volcanos. — Centr. Asia: Balkh. (north of Lake Balkhash; Kounradski volcanos, Bek-Tau-Ata Mountains, Karkaralinsk district). Endemic. Described from Kounradski volcanos in the northern part of the Lake Balkhash area. Type in Leningrad.

Note. This species is closely related to *Z. latifolium* Schrenk from which it is distinguished by its smaller leaflets and fruits. It differs from *Z. rosovii* Bge. by smaller fruits, shape of sepals, obtuse leaflets and seeds, as well as by other characters.

Series 3. *Turcomanica* Boriss. — Capsules wingless, long-cylindrical, curved; leaflets 1–2, rarely 3 pairs; stipules scarious, small.

11. *Z. turcomanicum* Fisch. et Mey. in Bull. Soc. Nat. Mosc. II (1839) 149, nomen solum; Bge. Rel. Lehm. (1851) 235; Boiss. Fl. or. I (1867) 914; O. and B. Fedch., Perech. r. Turk. I, 154; M. Pop. in Byull. S. A. G. U. 11 (1925) 118. — Ic.: M. Pop. l. c. tab. 5(2) f. 11.

69 Perennial; glabrous smooth plant; root thick, woody; caudex multicapital, branching into short erect branches; stems herbaceous, simple, many, ca. 10–25 cm long; stipules small, 1–2 mm long, scarious, free, triangular, acute; usually dentate at margin; leaves with 1 or 2 pairs of leaflets; petioles of lower and median leaves longer than leaflets, 15–20 mm long, distinctly jointed near leaflets; leaflets fleshy, narrow, linear-cylindrical or linear-spatulate, obtuse, broader at apex than petioles, 5–15 mm long, 1–2 mm wide. Pedicels thin, as long as flowers or slightly shorter; flowers nearly drooping, solitary or in pairs; sepals broadly membranous [at margin], 5–8 mm long, as long as or shorter than petals, red at base; stamens exerted; staminal scales shallowly fimbriate-dissected, sometimes with solitary lateral appendages; capsules linear or linear-oblong, 15–35 mm long, on short drooping pedicels, angular, acuminate at both ends; seeds linear-oblong, acute, coating gray and uniformly finely tuberculate, ca. 5 mm long. Fl. May–June, Fr. June–July.

Eastern shores of the Caspian Sea, chalk mountains, limestone slopes. — Centr. Asia: Ar.-Casp. (Mangyshlak Peninsula, Ust-Urt. Krasnovodsk Gulf, Emba River, chalk mountains of Astau-Saldy and Ak-Kerege). Endemic. Described from the Karelin collections of Cape Tyukkaragan in the eastern shore of the Caspian Sea. Type in Leningrad.

Note. This species is similar to *Z. miniatum* in fruit. The specimens from Ust-Urt and Balkhany differ from the typical form by the size of the entire plant and size and shape of the leaflets and flowers.

Local inhabitants call this plant "kryk-puun," meaning "40 joints," because of the brittleness of the stems and leaves.

12. *Z. dielsianum* M.Pop. in Schedis ad Herb. Fl. As. Med. fasc. XVIII (1928) 75. — *Z. miniatum* ssp. *Dielsianum* M.Pop. in Byull. S.A.G.U. 11 (1925) 122. — Ic.: in Byull. l. c. tab. 5 (2), f.13b. — Exs.: H. F. A. M. No.432.

Perennial; plant glabrous, greenish, with woody and branching caudex; root robust, woody, multicipital; stems numerous, sulcate, branching, 20–40 cm high; stipules membranous, broadly triangular, finely toothed; free; leaves (1.5)2–4 cm long, with 1.5–2 cm long petioles; leaflets thick, of median and lower leaves 1–3 pairs, oblong or lanceolate-oblong, of the upper 1–2 pairs, linear, all obtuse, hardly petioluled, 10–15(30) mm long, 2–4(6) mm wide. Flowers solitary or twin, on ca. 8 mm long thick pedicels; sepals oblong-obovate, obtuse, broadly membranous at margin, 7–8 mm long; petals obovate, cuneate at base, 7–8 mm long; stamens unequal, 5 mm and 10 mm long; staminal scales oblong-linear, fimbriate mostly at apex, dorsally scabrous-papillate; ovary with long filiform style persistent in young fruits; capsules many, drooping, cylindrical-linear, slightly falcately curved, acute, with acute edges, wingless, 30–35 mm long; seeds oblong-lanceolate, ca. 5 mm long, covered with papillae. Fl. April–May, Fr. June–July.

Saline soils in deserts, solonchaks along banks of lakes. — Centr. Asia: Balkh. (Golodnaya steppe, Dzhety-Sai), Syr D. (Ak-Syken Lake, north of Kokand). Endemic. Described from Dzhety-Sai in the Golodnaya steppe. Type in Leningrad.

Note. The description of the flowers was taken from Popov since there was no material with flowers at our disposal. The specimens collected in the deserts near Ak-Syken Lake, located south of Kurama Range, differ from the typical *Z. dielsianum* M.Pop. by their larger, flatter leaves, sometimes up to 3 cm long and up to 6 mm wide.

Series 4. *Subtrijuga* Boriss. — Capsules wingless, short-oblong; leaflets 3, rarely 2–4 pairs; stipules herbaceous, narrowly scarious at margin.

13. *Z. subtrijugum* C.A.M. in Ldb. Fl. alt. II (1830) 105; Fisch. Zytophyll. 9; Ldb. Fl. Ross. I, 484; O. and B. Fedch., Perech. r. Turk. I, 155; M.Pop. in Byull. S.A.G.U. 11, 122; Kryl., Fl. Zap. Sib. VIII, 1847. — *Z. trijugum* Meyer ex Ldb. Reise (1830) 398 (nomen). — Ic.: Ldb. Ic. Fl. Ross. IV, tab. 383; Pop. l. c. fasc. 12, tab. 6 (3) f.14. —

Perennial; root vertical, equally thickened, multicipital; stems many, 20–25 cm long, 2–2.5 mm thick, smooth, glabrous, prostrate or ascending, branching nearly from base into long shoots, otherwise simple; stipules mostly connate, herbaceous, leaf-like, narrowly scarious at margin, the

lower ovate or orbicular, ca. 3 mm long, the upper 1–2 mm long; leaves 2–2.5 cm long, with short flat and winged 3–7 mm long petioles ending in short subulate scarious mucro; leaflets 3, rarely 2–4 pairs, sessile, flat, thick, oblong-ovate to linear-oblong, 8–17(20) mm long, 3–5(8) mm wide, obtuse, glaucous, oblique, cuneate-tapering at base. Flowers axillary, 2 or 1 in axil, on thin 7–15 mm long pedicels, generally erect, sometimes drooping in fruit; sepals ovate or oblong, 5–7 mm long, narrowly white-margined; petals white, purple at base, as long as or slightly longer than calyx, oblong, obtuse; stamens as long as petals, enclosed in flowers; scales linear, fimbriate at apex, entire at margin; capsules as long as pedicels, 171 oblong-cylindrical or oblong-oval, (12)15–20 mm long, 5–6 mm wide, equal along the entire length, obtusely 5-ribbed, wingless, obtuse at both ends, sometimes rounded, with partly persistent mucronate style; seeds 4–4.5 mm; long, 2 mm wide, oblong-reniform, tapering at one end, smooth, grayish with dense papillae. Fl. May–June, Fr. June–July.

Clayey riverbanks, gravels, solonchak steppes, solonchak banks. — W. Siberia: Irt. (SE); Centr. Asia: Balkh. Endemic. Described from Irtys River. Type in Leningrad.

14. *Z. balchaschense* Boriss. sp. nova in Addenda XIII, 725. —

Perennial; root vertical, robust, multicapital; stems many, branching from base, erect, 10–15 cm high, glabrous, sulcate; stipules connate, herbaceous, green, sometimes dentate, suborbicular or ovate, ca. 2 mm long, ca. 3 mm wide, the upper thin-membranous at margin; leaves 1.5–2.5 cm long, petioles winged and thickened, rachis often terminating in a leaflet (leaves unpaired) or soft subulate mucro (leaves paired); leaflets 3–4 pairs, thick, oblong-lanceolate to linear, acute or obtuse, 8–12 mm long, 1.5–3 mm wide, tapering at base, green. Pedicels hardly longer than flowers or shorter; flowers 1–2 in axil, erect; receptacle thickened; sepals 5 mm long, three sepals orbicular with thin white membranous margin, ca. 4 mm wide, two sepals ovate, green, ca. 3 mm wide; petals white, 7 mm long, ovate, obtuse; stamens ca. 8 mm and 9 mm long; staminal scales basal, linear, ca. 5 mm long, fimbriate at apex, densely villous outside; ovary oval, smooth; style nearly as long as ovary; capsules oval-globose 5-ribbed, partly drooping, 8–10 mm wide, 10–14 mm long, obtuse, with persistent filiform style, many-seeded; seeds ca. 3–3.5 mm long, 1.5 mm wide, oblong, tapering at one end, rough, densely covered with papilliform-bristles. Fl. May, Fr. June–July.

Along banks, apparently on saline soils. — Centr. Asia: Balkh. (Lake Balkhash, Tokrau River north of Lake Balkhash). Endemic. Described from the vicinity of Lake Balkhash. Type in Leningrad.

Note. Related to *Z. subtrijugum* C. A. M. from which it is distinguished by the globose-oval capsules, shape of the leaves, erect stems (stems in *Z. subtrijugum* spreading, with long shoots), shape of floral parts, etc.

Series 5. *Furcata* Boriss. — Fruit cylindrical, acuminate, wingless; leaflets 1 pair, diverging, without distinct articulation at the winged petiole.

- 172 15. *Z. furcatum* C.A.M. in Ldb. Fl. alt. II (1830) 106; Ldb. Fl. Ross. I, 486; Fisch. Zygophyll. 12; O. and B. Fedch., Perech. r. Turk. I, 154; Kryl., Fl. Zap. Sib. VIII, 1846; M. Pop. in Byull. S.A.G.U. 11, 116. — Ic.: Ldb. Ic. Fl. Ross. IV, tab. 373.

Perennial; root woody, robust, multicapital; plant scabrous with fine short obtuse papillae; stems many, 5–15 cm high, erect or ascending, herbaceous, green, sulcate, brittle, few-branched; stipules dry-membranous, small, 1–2 mm long, oblong, acuminate, the lower obtuse, broadly triangular, irregularly dentate-serrate; petioles (like leaves) fleshy, 3–10 mm long, nearly as long as or shorter than leaves, without awnlike mucro, green, slightly dilated in upper part, not jointed with leaflets; leaflets 1 pair, linear, attached to petiole, 5–10(25) mm long, 1–2(3) mm wide at apex, furcately diverging. Flowers on 4–7 mm long pedicels; sepals elliptic, obtuse, white-scarious at margin, 5–6 mm long, ca. 3 mm wide; petals as long as calyx, 2–2.5 mm wide, oblong-obovate; staminal scales half as long as filaments, oblong-elliptic, shallowly fimbriate at apex; capsules solitary, (5)10–20 mm long, on 5–7 mm wide [?] pedicels, lanceolate-cylindrical, obscurely pentagonal, acuminate and slightly curved at apex; seeds ca. 4 mm long, 1.5 mm wide, gray, densely verrucose, ripe seeds covered with gray intact coating. Fl. May–June, Fr. July–August.

Solonchaks, solonchetses, sandy-gravelly soils. — W. Siberia: Alt. (Chingis-Tau); Centr. Asia: Ar.-Casp. (Akmolinsk and Karkaralinsk districts), Dzu.-Tarb. (Chilik River). Endemic. Described from Alta. Type in Leningrad.

Note. The specimens from the Chilik River valley differ somewhat by the smaller size of the whole plant and the smaller, 5–10 mm long, acute and narrowly winged fruits.

Section 2. *PTEROCARPIUM* Boriss. in Addenda XIII, 725. — Capsules narrowly or broadly winged, globose or oblong to lanceolate, acuminate, tapering at apex. Plants of the eastern part of Central Asia and the western part of Middle Asia.

Series 1. *Oxycarpa* Boriss. Low plants; capsules oblong, obtuse or acuminate at base, tapering at apex; leaflets 2–3–4 pairs, usually thick; stipules scarious, rarely herbaceous.

16. *Z. oxycarpum* M. Pop. in Byull. S.A.G.U. 12 (1926) 112, pro min. parte; Kryl., Fl. Zap. Sib. VIII, 1848, p. p. — Ic.: M. Pop. l. c. tab. 6(3) f. 19. — Exs.: H. F. A. M. No. 189.

- 173 Perennial; root thick, multicapital, woody; caudex lignified, thick, short; stems many, spreading, flexuose, simple or few-branched, thin, up to 1.5 mm thick, 10–12 cm high; stipules scarious, white, ovate, the upper lanceolate, finely dentate at margin, ca. 1 mm long; leaves 2–3 cm long; petioles 10–20 mm long, with subulate membranous mucro at apex, petioles of lower leaves longer than leaves; leaflets 2–3 pairs with 4–5 mm between each pair, thick, oblong-linear, cuneate at base, slightly dilated in upper part, obtuse, (5)8–20 mm long, 1–2.5 mm wide. Flowers 1, rarely 2 in axil, on

3–5 mm long pedicels recurved in fruit; sepals 6–7 mm long, 2.5–3 mm wide, oblong-ovate, narrowly scarious at margin, obtuse; petals obovate, cunate at base, rounded above, slightly shorter or as long as calyx; stamens and styles not exerted from flowers, nearly as long as petals; staminal scales up to one-third as long as filaments, linear, obtusely crenate along margin, crenate and obtuse at apex; capsules membranous, cuneate-lanceolate, obtuse and broad at base, tapering at apex, acute, yellowish when ripe, 20–30 mm long, 7–10 mm wide at base, narrowly 5-winged, wings 2–3 mm wide; seeds obliquely ovate, laterally compressed, rounded at base, acuminate at apex, 3.5–4 mm long, 1.5–2 mm wide. Fl. April–June, Fr. May–June. (Plate X, Figure 8.)

Stony places. — Centr. Asia: Balkh. (Zaisan district, restricted to Mai-Kopchegai, Cherny Irtysh river valley, Kusto River, Kyzyl-Kain River). Gen. distr.: Dzu.-Kash. (adjacent parts of China). Described from the Zaisan depression. Type in Leningrad.

Note. Popov's diagnosis of *Z. oxycarpum* has been considerably changed; it actually refers only to those specimens from the Zaisan depression. In the other places mentioned in his work there are other species, e.g., *Z. karatavicum* Boriss. which is completely isolated. The plants collected by Sovetkina on Kara-Tau Range under the name "*Z. oxycarpum*" are in fact *Z. karatavicum* Boriss.

17. *Z. kopalense* Boriss. sp. nova in Addenda XIII, 726.

Perennial; root thick, multicipital, woody; stems many, 6–8 cm long, thin, sulcate, branching; stipules small, ca. 1 mm long, scarious, white, triangular-ovate; leaves 2–3 cm long; petioles nearly as long as rachis, with short green mucro at apex; leaflets (2)3–4 pairs, oblong to oblong-oval, 5–8 mm long, 2–3 mm wide, obtuse. Flowers on pedicels nearly as long as flowers or shorter; sepals ca. 8 mm long, ca. 2 mm wide; petals white, slightly longer than calyx, 9–10 mm long, ca. 3 mm wide; stamens 174 ca. 5 mm long; staminal scales lanceolate, nearly half as long as filaments; ovary acute at apex, dilated at base; immature capsules acuminate, 5-ribbed, erect. Fl. May.

Solonetzic places of red clayey shales, clayey solonetzic soils. — Centr. Asia: Balkh. (basin of Kopa and Sary-Bulak rivers, northern shores of Lake Balkhash). Endemic. Described from the Kopa River basin, natural boundary of Dulon-Kara. Type in Leningrad.

18. *Z. cuspidatum* Boriss. n. sp. in Addenda XIII, 726. — *Z. mucronatum* M. Pop. in Byull. S. A. G. U. 11 (1925) 119, p. p. non Maxim.

Perennial; root robust, thick, short, multicipital, woody; plant pulvinate, with multicipital caudex; stems many, herbaceous, 5–6 cm high, thin, fragile, finely sulcate, glabrous or very sparsely beset with obtuse prickles, straight or flexuose, few-branched, one-year-old shoots lignified below; stipules very small, 0.5–1 mm long, membranous, white, not connate, double, triangular-ovate, dentate-fimbriate at margin; leaves 1.5–2 cm long, fleshy, with 2–3 pairs of leaflets, rachis constricted at joints, short internodes between leaflets and a subulate mucro at apex; leaflets (like petioles) covered with obtuse papillae, oblong or oblong-lanceolate, obscurely acuminate at apex, mucronate or obtuse, 4–8 mm long, 1.5–2 mm wide. Flowers

unknown; fruits axillary, drooping, oblong, 10–17 mm long, ca. 5 mm wide, mucronate, 5-winged, membranous, on 4 mm long pedicels; seeds ca. 3 mm long, 1 mm wide, tapering and acute at one end and obtuse on the other, pale green, smooth, distinctly foveolate under magnification. Fr. end of June.

Pebbly semidesert, foothills. — Centr. Asia: Dzu.-Tarb. (Dzharkent district). Endemic; growing possibly in the adjacent parts of Dzu.-Kash. Described from Dzharkent district between Temerlik and Chushanai valley. Type in Leningrad.

Note. *Z. cuspidatum* differs from *Z. mucronatum* Maxim., with which it is intermixed, by its pulvinate habit, low stature, robust many-branched root, membranous stipules, 5-winged and not pentagonal capsules, and by the size, shape and texture of the seeds. *Z. mucronatum* Maxim., which was described from Alashan Range in Mongolia, occurs, in addition to Mongolia, also in Kansu province, but is not encountered in the USSR.

19. *Z. karatavicum* Boriss. sp. nova in Addenda XIII, 726. — Exs.: H. F. A. M. No. 189 (sub. *Z. oxycarpo* M. Pop.).

Perennial; root thick, vertical; caudex multicapital, short; stems many, 175 erect, simple or few-branched in upper part, 1.5–2 mm thick, 8–14 cm high, finely sulcate; stipules triangular-ovate, membranous or herbaceous, white-scarious and fimbriate-dentate at margin, ca. 1–1.5 mm long; lower leaves 3–4 cm long, the upper 2–3 cm, rachis with filiform white mucro at apex; petioles 10–20 mm long; leaflets (2)3–4 pairs, 6–10 mm between each, spatulate, cuneately tapering at base, obtuse at apex, 5–10 mm long, 2–3 mm wide above. Flowers drooping post-anthesis, 1 or 2 in axils, on 5–6 mm long pedicels; three sepals 7 mm long, ca. 4 mm wide, ovate, acute, two sepals oblong, 6 mm long, 3 mm wide, obtuse above, slightly tapering at base; petals 3 mm long, with broad blade, 2.5–3 mm wide, narrowly clawed, obtuse at apex; stamens ca. 3 mm long, with anthers ca. 1 mm long; staminal scales long-adnate to filaments, slightly fimbriate at apex; style filiform, hardly longer than stamens; ovary slightly shorter than stamens, oblong-ovoid, 5-ribbed; capsules ovoid, asymmetrical, 5-winged, slightly tapering, obtuse, 15–18 mm long, ca. 8 mm wide, widest at the middle; seeds (unripe) oblong, tapering at one end, obtuse at the other, and smooth, dark brown, 2–5 in each cell. Fl. May, Fr. June. (Plate X, Figure 7.)

Stony mountain slopes. — Centr. Asia: T. Sh. (Kara-Tau Range). Endemic. Described from Kara-Tau Range. Type in Leningrad.

Note. This species is distinguished from *Z. oxycarpum* M. Pop. by the number of pairs of leaflets, their size and shape, the longer pedicels, the size and shape of capsules, as well as by a number of other characters.

Series 2. *Annua* Boriss. — Annuals, with oblong capsules; leaflets 1- or 2-paired; stipules wholly membranous or only at margin.

20. *Z. lehmannianum* Bge. in Mém. savant étrang. VII (1851) 237; O. and B. Fedch., Perech. r. Turk. I, 155; M. Pop. in Byull. S. A. G. U. 12 (1926) 110. — *Z. Karelini* F. et M. in Bull. Soc. Nat. Mosc. (1839) 149, nomen nudum; Boiss. Fl. or. I (1867) 910. — Ic.: Bge. Ic. pl. nov. Lehm. (1848) tab. 10; Bge. in Arb. Naturw. Vereins zu Riga, I, 2, tab. 10; M. Pop. l. c. tab. 6 (3) f. 17. — Exs.: H. F. A. M. No. 187.

Annual; root simple, vertical, yellowish; low plant, 8–12 cm, glabrous; stems many, diffuse, furcately branching from base, angular, fleshy, procumbent; stipules small, ovate, acute, transparent, wholly membranous or at margin; leaves mostly uniparous, the median biparous; petioles and rachis broad, almost winged, constricted at joint with leaflets; rachis terminating in very short mucro; leaflets 7–15 mm long, ca. 5 mm wide, nearly oblique, obovate-oblong, rounded at apex, sometimes partly or all 176 connate at base. Flowers yellow, axillary, mostly solitary or twins (sometimes the older abortive), on very short, ca. 1.5 mm long thick pedicels; sepals yellow, obovate, hardly marginate, obtuse, 5 mm long, 3 mm wide, usually 3-nerved; petals slightly shorter than calyx; stamens not exerted from flowers; staminal scales adnate to filaments, narrow, very finely toothed at margin, one-half to three-fourths as long as filaments; ovary ca. 3 mm long; style ca. 1.5 mm long; capsules drooping, 5-locular, ca. 20–25 mm long, ca. 8 mm wide when ripe, broadly elliptic, indurate-subcoriaceous, angular, with 5 reticulate wings 2–3 mm wide and nearly twice as wide as cell, many-seeded; seeds flattened, nearly angular, 3–5 mm long. Fl. April, Fr. May–June.

Clayey and marly soils, solonchaks, dry hills, gypsum soils. — Centr. Asia: Kara K. (shores of the Caspian Sea), Mtn. Turkm. (spurs of Kyuren-Dagh Range), Syr D. (Kokand and Margelan districts), Dzu.-Tarb. (Dzharkent district). Gen. distr.: Kuldja. Described from near Novo-Aleksandrovsk. Type in Leningrad.

Series 3. *Marginulata* Boriss. — Capsules narrowly winged, oblong; leaflets 1–3 pairs; stipules scarious.

21. *Z. iliense* M. Pop. in Byull. S. A. G. U. 12 (1926) 112. — Ic.: M. Pop. l. c. tab. 6, f. 17.

Perennial; root woody, thickened, flexuose; stems many, 5–15(20) cm long, decumbent or ascending, herbaceous, dry, brittle, striate, glabrous, few-branched, with 2–5 cm long internodes in fruit; stipules all free, white-membranous, small, ca. 1 mm long, the lower broadly ovate-triangular, the upper lanceolate, finely toothed at margin; leaves 1–2 cm long, with petioles 4–6 mm long ending with subulate membranous mucro; leaflets 1–3 pairs, lower and median leaves 3- and 2-paired, the upper sometimes with 1 pair, flat, glabrous, smooth, broadly oval or suborbicular, obscurely nerved. Flowers 1–2 in axil, on 4–5 mm long pedicels; sepals oblong, obtuse, 5–6 mm long, hyaline-membranous, at margin; petals obovate or oblong, rounded or obtuse at apex, apparently orange at base, three times as long as calyx; stamens prominently exerted, nearly twice as long as flowers; staminal scales oblong below, one-third as long as filaments; capsules cylindrical or oblong, membranous, glabrous, immature capsules ca. 2 cm long, 6 mm wide, obtuse at both ends, narrowly winged, with long persistent style. Fl. June, Fr. unripe July.

177 Slopes, riverbanks, ca. 800 m. — Centr. Asia: Dzu.-Tarb. (Khorgos, Karasu, Khan-Tau, at foot of Altyn-Emel mountain pass). Endemic. Described from the Ili River valley. Type in Leningrad.

Series 4. *Pterocarpa* Boriss. — Capsules oblong-oval or oval, rounded at both ends; leaflets 1–3 pairs; stipules green, herbaceous or scarious or only scarious at margin.

22. *Z. pterocarpum* Bgè. in Ldb. Fl. alt. II (1830) 103; Fisch. Zygoph. 9; Ldb. Fl. Ross. I, 484; Maxim. Enum. pl. Mong. 127; Kryl., Fl. Zap. Sib. VIII, 1848; M. Pop. in Byull. S. A. G. U. 12 (1926) 113. — *Z. altaicum* Steph. in herb. — Ic.: Ldb. Ic. Fl. Ross. IV, tab. 382; M. Pop. l. c. tab. 6 (3), f. 20.

Perennial; plant glabrous, glaucescent; root woody, multicipital; stems lignified at base, numerous, spreading, thin, finely sulcate, furcately branching into thin spreading branches, 10–15(20) cm high; stipules green, white-membranous only at margin, ovate, rounded at apex, the upper lanceolate, 1–1.5 mm long, appressed when young, later recurved then deciduous; leaves 7–12 mm long, usually with 2 or 3 rather approximate pairs of leaflets; petioles short, 4–6 mm long, narrowly winged, flat, ending with ca. 0.5 mm long subulate whitish recurved mucro, sometimes terminating in a leaflet, petioles of lower leaves shorter than leaflets; leaflets thick, flat, linear-oblong or lanceolate, 5–13(15) mm long, 1.5–3(5) mm wide, glabrous, glaucescent, acute. Pedicels 5–10 mm long, later elongating; flowers twin or solitary in axil; sepals elliptic, obtuse, 5–7 mm long, 4–4.5 mm wide; petals oblong-obovate, obtuse at apex, entire, slightly longer than calyx; 7–10 mm long, whitish in upper part, orange below, tapering at base to rather long cuneate claw; stamens orange, hidden in flowers; staminal scales nearly half as long as filaments, oblong-lanceolate, serrate-dentate at margin, shallowly fimbriate at apex; ovary oblong; style erect, nearly as long as stamens; capsules oblong-oval or oval, rounded at both ends, rarely acute, 10–20 mm long, 6–10(12) mm wide, pentahedral, with 2–3 mm wide wings, membranous; seeds 3–4 mm long, 1.5–2.5(3) mm wide, oblong-ovate, obtuse at one side, densely covered with gray papillae. Fl. June–July; Fr. July–September.

Clayey-solonchik and clayey-sandy slopes, solonchik meadows in clayey deserts. — W. Siberia: Alt. (Chuya steppe, S. Altai); Centr. Asia: Balkh. (Zaisan district, Ili River). Gen. distr.: Dzu.-Kash., Mong. (Mong. Altai, Gobi). Described from the Chuya River. Type in Leningrad.

178 23. *Z. taldy-kurganicum* Boriss. sp. nova in Addenda XIII, 727.

Perennial; glabrous plant; root robust, woody, with numerous cordlike branches; stems many, woody at base, flexuose, branching, sulcate, ca. 15 cm high; stipules scarious, the lower ovate, the upper lanceolate, acuminate, ca. 2 mm long; leaves 1.5–2 cm long, with 2 pairs of leaflets, rachis with inconspicuous white mucro at tip; petioles as long as or slightly longer than rachis; leaflets thick, flat, broadly ovate, 8–12 mm long, 5–9 mm wide, obtuse, asymmetrical, glabrous. Flowers unknown; fruiting pedicels 2–4 mm long; capsules oblong, 2.5–3 cm long, 10–14 mm wide, membranous, with wings as wide as cells; seeds ovate, large, ca. 6 mm long, 3 mm wide, obtuse at one side, acute at the other, gray, covered with papillae. Fr. July.

Gypsum clays. — Centr. Asia: Balkh., Dzu.-Tarb. (Taldy-Kurgan district). Endemic. Described from the Kara-Tal River and Lake Uch-Kul. Type in Leningrad.

Series 5. *Fabagoidea* Boriss. — Capsules globose or oval, narrowly winged or acute at ribs; leaflets 2, sometimes rachis terminating in a leaflet (leaves ternate); stipules herbaceous.

24. *Z. fabagoides* M. Pop. in Byull. S. A. G. U. 11 (1925) 113. — Ic.: M. Pop. l. c. tab. 4 (1) f. 3.

Perennial; plant 20–40 cm high, woody at base; stems indurate, spreadingly-branching from base, with elongate internodes, finely sulcate, straw-yellow, pale green in the upper part, shiny below, glabrous, smooth; stipules herbaceous, the lower suborbicular, connate, 2–3 mm long, the upper free, short, 1–1.5 mm long, triangular-ovate; leaves remote, with thin 8–18(20) mm long petioles, terminating in short subulate-setiform mucro; leaflets always 1 pair, oblong or ovate, obtuse, slightly asymmetrical, flat, thick, 1.2–2.5 cm long, 6–11 mm wide. Flowers 2 in axil, on 8–12 mm long thin pedicels; flower buds rotund; sepals 5, ovate-orbicular, green, membranous at margin, unequal, two larger, ca. 5 mm wide, 6–8 mm long, three others 4–5 mm wide, 5 mm long; petals white in upper part, orange at base; stamens 10–12 mm long, with ca. 2 mm long anthers, filaments long, orange; staminal scales 3–4 mm long, linear, fimbriate at margin, style white, filiform, erect, ca. 8 mm long; ovary 5-locular, ovoid, glabrous. Fl. May–August, Fr. August.

Sands, sandy hills, tugai (bottomland complex with forests, bushes and meadows in river valleys — Middle Asia, USSR). — Centr. Asia: Balkh. (Ili River valley, sands of Muyun-Kum), Dzu.-Tarb. Endemic. Described from the Ili River near Dubun. Type in Leningrad.

179 25. *Z. eichwaldii* C. A. M. in Eichw. Pl. casp.-cauc. (1831–1833) 15, pro parte excl. hab. pr. Guriew; Ldb. Fl. Ross. I, 485, p. p.; Boiss. Fl. or. I, 914; O. and B. Fedch., Perech. r. Turk. I, 154. — *Z. Eichwaldii* var. α . Bge. Rel. Lehm. (1851) 236. — *Z. ramosissimum* M. Pop. in Byull. S. A. G. U. 11 (1925) 115. — Exs.: H. F. A. M. No. 433 (sub *Z. ramosissimum* M. Pop.). — Ic.: Eichw. l. c. tab. 14; M. Pop. l. c. tab. 5 (2) f. 6.

Perennial; semishrub, sometimes up to 1 m high; stems usually woody, smooth, yellowish, furcately much branching from base or from the middle, branches thin, spreading, finely sulcate, virgate; lower stipules connate, herbaceous, ovate, 5–7 mm long, the upper paired, free, small, nearly membranous, lanceolate; leaves generally 1-paired; petioles shorter than blade, 5–15 mm long, short-mucronate or lanceolate at apex; [leaflets] asymmetrical, flat, thick, 15–25 mm long, 5–7 mm wide, upper leaflets linear or narrowly linear to subfiliform, much longer than petioles, 1–2 mm wide, 10–20 mm long. Flowers mostly solitary, nearly regular (hardly zygomorphic); pedicels thin, nearly as long as calyx, 5–8 mm long; sepals 5–6 mm long, oblong or obovate, broadly membranous-hyaline at margin, three sepals 3 mm wide, 2 ca. 1.5 mm wide; petals nearly as long as or slightly shorter than sepals, ca. 6 mm long, spatulate, obtusely emarginate, bright red at base; stamens prominently exerted; staminal scales linear, adnate to filaments at base, serrate-dentate at apex and margin; capsules small, globose-oval or globose-ovoid, with 5 acute ribs, 8–10 mm long, 7–8 mm wide, on drooping pedicels; seeds large, 6–7 mm long, reniform or oblong, black, the unripe glabrous. Fl. April–May. (Plate IX, Figure 3.)

Sandy deserts. — Centr. Asia: Kara K., Kyz. K., Pam.-Al. (Samarkand). From Cheleken on the Caspian Sea to Samarkand in the east. Endemic. Described from Lake Dagoda in Balkhanskii bay. Type in Leningrad.

Note. *Z. eichwaldii* C.A.M. s. str. is distributed more to the south than *Z. ovigerum* F. et M. Apparently the two species grow closely to each other near Kara-Bogaz Gol. A thorough examination of the pubescence did not show the similarity which Popov noted when placing them in the synonymy of *Z. eichwaldii*, subsequently redescribed as *Z. ramosissimum* M. Pop. Boissier correctly distinguished them. Meyer, in describing *Z. eichwaldii*, comprehended this taxon in a wide sense and included here specimens from Gur'ev referring to *Z. ovigerum* Fisch. et Mey., separated (in 1839) and redescribed (in 1851) by Bunge. The two species are readily distinguished from each other by the size of the flowers and fruits and by the shape of the petals and leaves. *Z. eichwaldii* is a semishrub, up to 1 m high in Kyzyl-Kum. *Z. ovigerum* is a herbaceous perennial. Each has its specific area of distribution.

26. *Z. ovigerum* Fisch. et Mey. in Bull. Soc. Nat. Mosc. (1839) 149, nomen; Bge. Rel. Lehm. (1851) 236, descriptio; Boiss. Fl. or. I, 914; O. and B. Fedch., Perech. r. Turk. I, 153; Fedch., Rast. Turk. 553. — *Z. Eichwaldii* C.A.M. in Eichw. Pl. casp.-cauc. (1831-1833) 15, quoad pl. e Gurjev. — *Z. Eichwaldii* var. *β. strictor* Bge. Rel. Lehm. (1851) 236. — *Z. Eichwaldii* M. Pop. Byull. S. A. G. U. 11 (1925) 144, non C.A.M. — Ic.: M. Pop. l. c. tab. 4(1), f. 5.

Perennial; glabrous plant, woody at base; stems 15-35 cm long, erect, herbaceous, finely sulcate, few-branched, branches ascending, alternate or opposite; stipules herbaceous, the lower connate, suborbicular, 5-6 mm long, 7 mm wide, the upper separate, narrower, broadly lanceolate, acute; leaves uniparous, 10-15 mm long petioles, ending with a thin mucro; leaflets 1.5-3 times as long as petioles, sessile, thick, flat, the upper linear, the lower oblong-elliptic, obtuse, 30-35 mm long, 3-10 mm wide. Pedicels erect at anthesis, 5-10 mm long, elongating, drooping in fruit; flowers mostly solitary, drooping, zygomorphic; receptacle abruptly oblique; sepals glabrous, oval, 8-10 mm long, obtuse, broadly white-membranous at margin; petals obovate, obtuse, entire, slightly longer than calyx, white, orange at base; stamens exserted; staminal scales large, dentate at apex, glandular-hairy; capsules subglobose or elliptic, nearly wingless, acute at ribs or narrowly winged, 10-15 mm long, 9-11 mm wide; seeds 4-6 mm long, gray. Fl. May-July, Fr. June-August. (Plate IX, Figure 2.)

Takyr (clay soil area in desert and semi-desert regions — Middle Asia, USSR), solonchaks, saline soils at margin of sands, shores, chalk limestones and marl soils. — European part: L. V. (Krasnoarmeisk, the vicinity of Gur'ev, Ryn-Peski); Centr. Asia: Ar. -Casp. (Inder Lake, Ust-Urt, shores of the Caspian Sea, Mangyshlak Peninsula), Kara K. (southern shores of Kara-Bogaz Gol). Endemic. Described from the shores of the Caspian Sea in N. Turkmenistan, from Karelin's collections.

Note. *Z. ovigerum* is distributed in the northwestern part of Central Asia along the shores of the Caspian Sea and in Ust-Urt, from the southern part of Kara-Bogaz Gol to Inder Lake in the north. Boissier quite

correctly distinguished *Z. ovigerum* from *Z. eichwaldii*, but Bunge in distinguishing them did not fully comprehend their geography, and thus included specimens of *Z. ovigerum* from the vicinity of Gur'ev (var. β .) in *Z. eichwaldii*.

Series 6. *Stenoptera* Boriss. — Fruit globose, winged; leaflets 2, furcately diverging, without a distinct joint at the foliaceous-winged petiole.

- 181 27. *Z. stenopterum* Schrenk in Bull. Phys.-Math. Acad. St.-Pétersb. III (1845) 308; Bge. in Bull. Soc. Nat. Mosc. XXXIII (1860) 466; O. and B. Fedch., Perech. r. Turk. 154; M. Pop. in Byull. S. A. G. U. 11 (1925) 116. — Ic.: Pop. l. c. tab. 5(2) f. 7. — Exs.: H. F. A. M. No. 434.

Perennial; root woody, robust, multicipital, with short thick branches in upper part; stems herbaceous, many, indurate, erect or ascending, 15–30 cm high, simple or sparsely branching; stipules small, scarious, the lower connate, broad, ovate, the upper separate, triangular, membranous; petioles shorter than leaves, 3–5 mm long, winged-foliaceous, indistinctly jointed with leaflets, terminating in a setiform mucro; leaflets 1 pair, linear, 10–20 mm long, 1–1.5 mm wide, terete, fleshy, obtuse. Flowers mostly solitary in axil, zygomorphic, on 4–8 mm long pedicels; sepals 5–6 mm long, narrowly white-margined; petals hardly longer than sepals; stamens much exserted; staminal scales lanceolate, deeply and narrowly dissected at apex into 2–3 curved lobes, finely dentate at margin, scabrous papillate above; capsules oval-globose, 10–15 mm long, 7–12 mm wide, obtuse at both ends, angular-winged, wings long, very narrow, twice as narrow as cell; seeds 5 mm long, 2 mm wide, gray with dense sessile papillae. Fl. June; Fr. July. (Plate IX, Figure 1.)

Saline sands, solonchaks, solonchak serozem, gypsiferous soils in deserts. — Centr. Asia: Balkh. (at foot of mountains near Dzhambul, in the delta of the Talas River, sandy steppes near Lake Balkhash). Endemic. Described from the vicinity of Dzhambul. Type in Leningrad.

Note. Similar to *Z. furcatum* in shape of leaves, but differing in shape of capsules and many other characters. *Z. eichwaldii*, resembling *Z. stenopterum* in shape of capsule, is distinguished by its herbaceous stipules, shape of the leaflets and other characters.

Series 7. *Macroptera* Boriss. — Capsules broadly winged, large, globose or oval; stipules scarious; leaflets 2–5 pairs; plants covered sparingly to more or less densely with short papilliform prickles.

28. *Z. kegensae* Boriss. in Addenda XIII, 727.

Perennial; root long, woody, multicipital, branching, densely tufted; stems herbaceous, usually erect, low, 5–10(15) cm high, sparsely covered with obtuse short prickles; stipules separate, scarious, white, triangular-lanceolate, fimbriate at margin; leaves 2–3 [m?] long, thick, glabrous, with petioles one-third as long as blade, and rachis constricted at joints with leaflets; leaflets 2–3(4) pairs, thick, lanceolate or lanceolate-oblong, 7–12 mm long, 1.5–2 mm wide, obtuse. Flowers 1–2 in axil, ca. 10 mm

182 long, on erect 5–10 mm long pedicels; sepals large, 8 mm long, 3–5 mm wide, elliptic, obtuse; petals 10–11 mm long, yellowish when dry, cuneate at base, obtuse at apex, varying in width, 3–5 mm wide; stamens slightly longer than petals; staminal scales one-third as long as filaments, linear, shallowly toothed at margin; ovary pentahedral, with long filiform style; capsules ovoid-oval, (1) 2–3 cm long, (1) 1.3–1.8 cm wide, slightly tapering at base, 5-winged, with thin membranous wings 7–9 mm wide, short-mucronate at apex, many-seeded, 3–5 seeds in cell; seeds ca. 4 mm long, ca. 1.5 mm wide, oblong, densely and finely granular, grayish. Fl. May–Dry, July.

Dry, clayey mountain slopes, gypsiferous variegated sandstones. – Centr. Asia: T. Sh. (Kegen district, Charyn River, Sary-Dzhas, Temerlykii and Sartogoi mountain passes). Endemic. Described from Kegen district. Type in Leningrad.

29. *Z. macropterum* C.A.M. in Ldb. Fl. alt. II (1830) 102; Fisch. Zygoph. 8; Ldb. Fl. Ross. I, 484; Boiss. Fl. or. I, 911; Kryl., Fl. Alt. 202; O. and B. Fedch., Perech. r. Turk. 2, 155; M. Pop. in Byull. S. A. G. U. 12 (1926) 114; Kryl., Fl. Zap. Sib. VIII, 1849. – *Z. pinnatum* Cham. et Schlecht. in Linnaea, V (1830) 48. – *Z. Steversianum* Stephan in herb. ex Ldb. Fl. Ross. I, 484, nom. nud. – *Z. coccineum* Schrenk in herb. – Ic.: Ldb. Ic. Fl. Ross. II, tab. 140; M. Pop. l. c. tab. 6 (3) f. 22.

Perennial; root robust, multicapital, woody; stems many, cespitose, spreading, partly ascending, (5) 10–20 cm high, like petioles, pedicels and calyx scabrous with very short obtuse prickles; stipules separate, white-scarious, ovate or lanceolate, acuminate, membranous and fimbriate or dentate at margin, (1) 1.5–2 mm long; leaves 20–30 mm long, with small soft membranous mucro at apex; petioles 10–23 mm long; leaflets 3–5 pairs, elliptic or obovate, obtuse, 5–12 mm long, 2–6(8) mm wide, thick, flat, glabrous. Flowers axillary, on 2–7 mm long pedicels, erect at anthesis, drooping in fruit; sepals elliptic, obtuse or short-mucronate, 5–6 mm long, 4–5 mm wide; petals slightly to 1.5 times as long as calyx, obovate, more or less crisp-hairy at apex, obtuse, sometimes emarginate, tapering below, orange; five stamens nearly as long as petals, 5 shorter; staminal scales oblong, truncate and deft at apex, not deeply fimbriate at margin, orange-red like stamens; capsules large, 2–4.5 cm long, 2–4 cm wide, subglobose or oval-globose, nearly as long as wide, membranous, wings broad, 5–12 mm wide; seeds 5–9 mm long, 2–3 mm wide, obliquely lanceolate, slightly flattened, yellowish or nearly grayish-greenish, densely and finely granular at surface. Fl. April–May, Fr. May–August. (Plate X, Figure 6.)

183 Solonchic soils and solonchaks, clayey slopes, stony desert soils. – European part: V.-Kama (Zilair canton, S. Bashkir ASSR); W. Siberia: U. Tob (Orsk district); Centr. Asia: Ar.-Casp. (eastern shores of the Caspian Sea, Akmolinsk, Aral Sea), Balkh. (Zaisan depression, Irtysh River valley), Kara K. (rarely), Kyz. K., T. Sh. (Naryn River), Pam.-Al. (upper reaches of Zeravshan). Gen. distr.: Iran (between Astrabad and Shakhru). Described from Irtysh River and Kurchum. Type in Leningrad.

Note. The typical *Z. macropterum* C.A.M. shown in Plate X occurs in the southern desert region of Altai and the Zaisan depression. It is extremely polymorphic throughout its huge distribution area. There

is no doubt that *Z. macropterum* s. lat. represents a series of closely related species differing in habitat but difficult to distinguish. Specimens from the chalk mountains at the shores of the Caspian Sea were indeed separated (var. *microphylla* Boriss.) and are characterized by their very small orbicular leaflets and smaller capsules. The existence of transitional forms (between the extreme west and east) at the center of the distribution area makes the division into individual species impossible. The E. Tien Shan race, *Z. kegenense* Boriss., which is confined to the mountain slopes of E. Semirechye, is easily discriminated.

Series 8. *Macropteroidea* Boriss. — Capsules large, broadly winged; leaflets 1–2 pairs, flat, large; stipules herbaceous, narrowly scarious at margin; glabrous plants.

30. *Z. potaninii* Maxim. in Mél. biolog. XI (1881) 174; Ejusd. Enum. pl. Mongol. (1889) 126; O. and B. Fedch., Perech. r. Turk. 1, 155; M. Pop. in Byull. S. A. G. U. 12 (1926) 113; Kryl., Fl. Zap. Sib. VIII, 1847. — Ic.: Maxim. Enum. pl. Mong. tab. XII, 1–10; Popov, l. c. tab. 6(3) f. 21.

Perennial; root cylindrical, multicapital; stems erect, spreadingly branching from base, glabrous, 10–17(25) cm high, thick, brittle, with internodes as long as or longer than leaves; stipules connate, herbaceous, narrowly scarious only at margin, broad and short, obtuse, finely crenate; leaves flat, with 3–8 mm long petioles, rachis winged, with scarious filiform mucro at apex; leaflets 1–2 pairs, obliquely obovate or orbicular, large, 10–25 mm long, 7–20 mm wide, 2–3-nerved. Flowers 2, sometimes 3, drooping, pedicels shorter than calyx, elongating post anthesis; sepals obovate, obtuse, yellowish, petaloid, 4–7 mm long, 4–5 mm wide; petals whitish, like stamens orange in the lower half, spatulate-obovate, tapering at base, usually short-acuminate at apex, finely undulate, slightly shorter than to sometimes half as long as sepals; stamens exerted from flowers; staminal scales glabrous, linear-oblong, half as long as filaments, fimbriate-dentate at the upper part; style long, prominent, twice as long as ovary; capsules drooping, chartaceous, oval-globose or subglobose, 15–25 mm long, 15–18 mm wide, 5-winged, with broad wings 5–7 mm; seeds ca. 5 mm long, 2.5 mm wide, densely short-papillate, flattened, obliquely ovate, 4–5 in each cell. Fl. May–June, Fr. June–August.

Pebbly, stony and sandy soils of semideserts. — Centr. Asia: Balkh. (basin of the Kaldzhir River near Chiganchia in the vicinity of Lake Zaisan). Gen. distr.: Dzu.-Kash. (C. Mongolia, Gobi Altai, Kuldja). Described from Mongolia. Type in Leningrad.

Subgenus 3. *Sarcozygium* (Bge.) Boriss. — Gen. *Sarcozygium* Bge. in Linnaea, XVII (1843) 7. — *Sarcozygium* Engl. Pflanzenfam. 19a (1931) 162. — Grex *Sarcozygium* subgeneris *Eazygophyllum* M. Pop. in Byull. S. A. G. U. 11 (1925) 105. — Shrubs. Flowers 4-merous; fruit a 3-winged large oval or globose capsule with thin chartaceous wings; leaves compound of 2 leaflets.

Section 1. XANTHOXYLON Boriss. — Flowers 4-merous. Capsules oval or globose, 3-winged, 3-locular, not depressed at apex. Glabrous plants.

31. *Z. ferganense* (Drob.) Boriss. comb. n. — *Z. xanthoxylon* var. *ferganense* Drob. in Sched's ad Herb. Fl. Ross. VIII (1922) 184. — *Z. xanthoxylon* ssp. *ferganense* M. Pop. in Byull. S. A. G. U. 12 (1926) 118. — Exs.: G. R. F. No. 2755.

Shrub, strongly branching, branches flexuose, spreading, often spinous, with grayish bark covered with whitish bloom, and with rigid lemon-yellow wood; stipules very small, membranous, triangular-orbicular; leaves small, with 2 fleshy leaflets, opposite on young branches, clustered on old branches; petioles 4–8 mm long, thin; leaflets thick, 3–7 mm long, 2–3 mm wide, small, oblong-spatulate or obovate, obtuse at apex, cuneate at base, slightly shorter than petioles. Buds globose; flowers 1–2, axillary, on 7–8 mm long thin pedicels, lemon-yellow, 4-merous; sepals 4, orbicular-oval, 5 mm long, 187 4 mm wide, thick, green, rounded at apex, narrowly white- and hyaline-membranous at margin; petals 4, 8–9 mm long, 5–6 mm wide at apex, orbicular or orbicular-ovate, obtuse, with very short ca. 1 mm long claw; four of which longer, 10–12 mm long; staminal scales linear-oblong, fimbriate at apex, 4–5 mm long; ovary 3-locular, very rarely 2-locular, trihedral; style filiform, slightly longer than stamens; capsules (15) 18–25 mm wide and long, on thick 7–10 mm long pedicels, globose, dehiscent, depressed [?] at apex and base, wings 3, broad, thinly membranous, finely nerved, two to three times as broad as cell; seeds 1–3 in each cell, 8 mm long, 3 mm wide, oblong, glabrous, olive-colored, faintly spongy-vesiculose at surface. Fl. March–April, Fr. May–September. (Plate X, Figure 2.)

Mountain slopes, very dry gypsiferous soils and conglomerates. — Centr. Asia: T. Sh. (Fergana–Ak-Bel mountains, Sokh River, Santo). Endemic. Described from Ak-Bel Range. Type in Leningrad.

Note. *Z. ferganense* Boriss. differs from *Z. xanthoxylon* Maxim., described from Mongolia, by the size and shape of leaflets, shape of capsules and flower parts. Subsp. *elongatum* Boriss. is encountered in the limestone-gypsum hills and conglomerate ridges of Mogol-Tau Range, Supe-Tau Mountain, near Khodzhent and in Chutskii district; it is characterized by the following features: elongate branches (less angular), petioles up to 2.5 cm long, leaflets oblong-spatulate, up to 1.5 cm long, 5 mm wide, sepals 7 mm long, oval, very narrowly membranous at margin, petals yellow, orbicular, 10 mm long, with distinct claw, stamens 10 and 13 mm long, capsules usually broader than long, 1.5–3 cm long, 1.8–3.5 cm wide, hardly emarginate, (10) 15–20 mm long on pedicels, seeds 1 in each cell, 8–9 mm long, ca. 3 mm wide.

32. *Z. kaschgaricum* Boriss. sp. nov. in Addenda XIII, 728. — *Z. xanthoxylon* auct. pro parte.

Shrub, with flexuose spinous branches and short internodes; bark glaucous-gray, obsoletely striated, wood yellow; stipules very small, membranous; leaves compound of 2 leaflets, fleshy, opposite in the young branches, clustered in the old branches, with 6–10(15) mm long petioles; leaflets fleshy, linear, nearly as long as petioles, 6–10(17) mm long, obtuse.

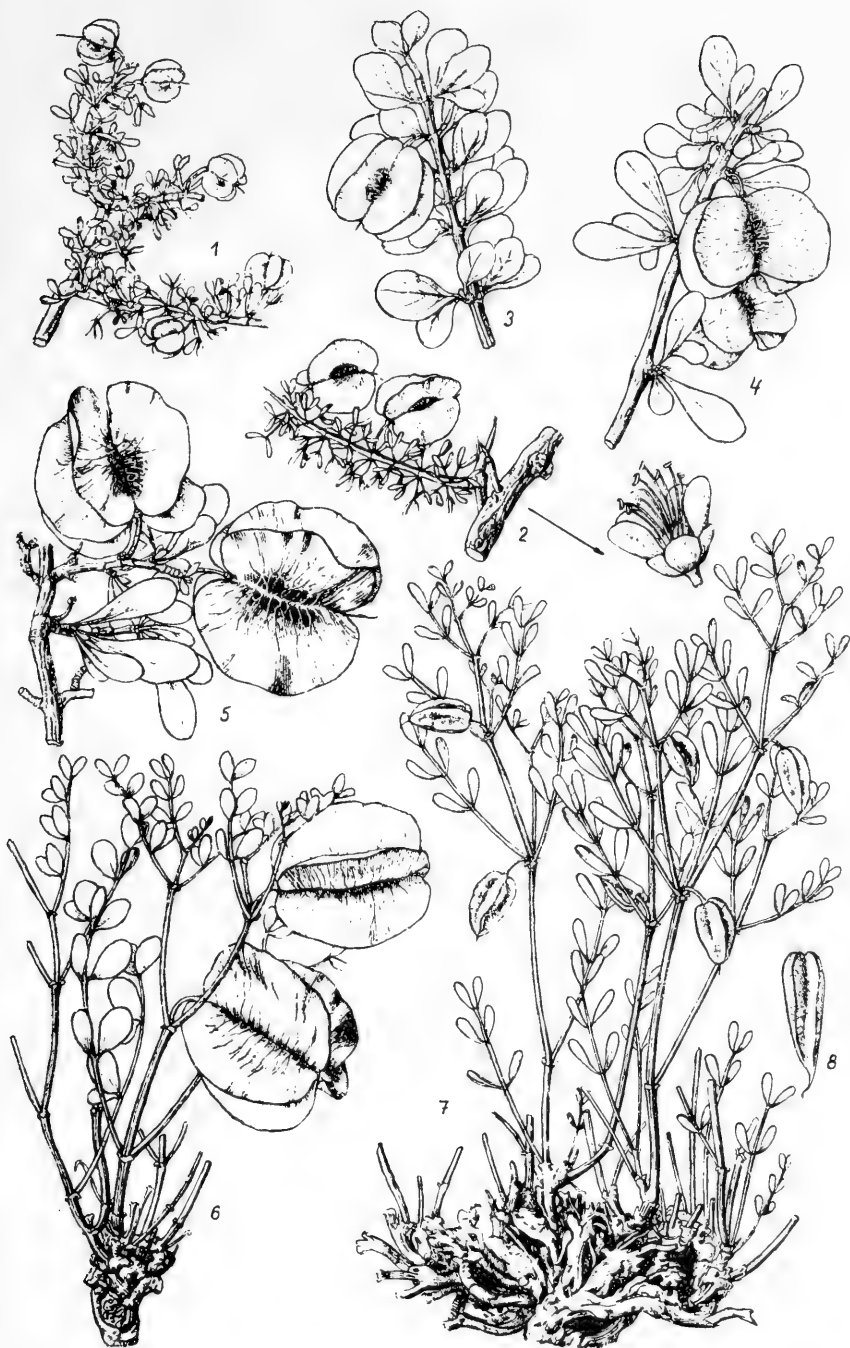


PLATE X. 1—*Zygophyllum bucharicum* B.Fedtsch.; 2—*Z. ferganense* (Drob.) Boriss.—
 3—*Z. gontscharovii* Boriss.; 4—*Z. euryprium* Boiss. et Buhse.; 5—*Z. megacarpum* Boriss.—
 6—*Z. macropterum* C.A.M.; 7—*Z. karatavicum* Boriss.; 8—*Z. oxycarpum* M.Pop.

Flowers 1–2 in axil, on 6–10 mm long pedicels; sepals usually persistent in fruit, (3)4, fleshy, oval; receptacle capitate, fleshy, concave; petals unknown; capsules oval, ca. 23 mm long, ca. 13 mm wide, attenuate at base, obtuse at apex, hardly depressed, of dull parchment-color, with thin reticular nerves, 3-winged, wings 1.5–2 times as broad as cell; seeds 1–2 188 in cell, semi-oblong, ca. 8 mm long, 2.5 mm wide, yellowish, vesiculose-spongy at surface. Fr. August.

Stony deserts, reddish soil of saz (habitat with high and permanent water table in arid regions of Middle Asia (USSR)), mountains of 1,400–1,700 m. Widespread in Kashgar, grows possibly in border regions of the USSR. Described from Kashgar. Type in Leningrad.

Note. *Z. kaschgaricum* differs from the Mongolian *Z. xanthoxylum* (Bge.) Maxim. by its shape and size of capsule, the color of wings, the persistent sepals, and the shape of leaflets.

Subgenus 4. *Dumosa* (M. Pop.) Boriss. — Grex *Dumosa* M. Pop. subgeneris *Euzygophyllum* in Byull. S. A. G. U. 11 (1925) 106. —

Dumosa M. Pop. in Engl. Pflanzenfam. 19a (1931) 162. — Shrubs. Flowers 5-merous; capsules winged, medium sized, ca. 1 cm in diameter, deeply emarginate, tapering at base, globose-conoidal; leaves with 2 leaflets and dilated foliaceous petioles.

33. *Z. bucharicum* B. Fedtsch. in Izv. Glavn. Bot. Sada. XVIII, 1 (1918) 13; M. Pop. in Byull. S. A. G. U. 12 (1926) 120. — Ic.: Fedtsch. l. c. tab. XVIII, No. 1; M. Pop. l. c. tab. 7 (4) f. 26. — Exs.: H. F. A. M. No. 431.

Shrub glabrous, stems angular, with strongly spreading branches, up to 75 cm high; branches alternate, angular, young branches thick, sulcate, gray-hairy, old branches woody, obsoletely striated, with cinereous-brown splitting bark; stipules connate, small, membranous, yellowish, broadly triangular; leaves with 2 leaflets and foliaceous petioles nearly as long as or slightly shorter than leaflets; young leaflets pubescent, developed, smooth, thick, oblong-lanceolate or spatulate, 5–10 mm long, 2–3 mm wide. Flowers regular, drooping or erect, on thin (5)7–10(12) mm long pedicels; sepals oblong or oblong-lanceolate, acute, 7–8 mm long; petals yellow, 10–12 mm long, long-clawed, blade oblong, acute; stamens slightly shorter than petals; scales fimbriate-dissected; capsules netted-veined, broader than long, 10 mm wide, 8 mm long, 4–5-locular, subglobose, with strong thin wings, depressed, with persistent style ca. 8 mm long; seeds 1, rarely 2 in each cell, crescent-shaped, oblong, flattened, obtuse, tapering slightly at one side, dark brown, the immature paler, nearly smooth, ca. 4 mm long. Fl. April–May, Fr. June. (Plate X, Figure 1.)

Gypsiferous variegated strata in dry hills. — Centr. Asia: Pam.-Al. (vicinity of Kelif and Shirabad). Endemic. Described from near Kelif. Type in Leningrad.

189 Note. This species resembles *Z. dumosum* Boiss. that grows in the dry deserts of Arabia and Palestine and differs by the staminal scales entire at margin, dentate at the truncate apex, the pubescent capsule and the completely isolated distribution area.

Z. bucharicum var. *albiflorum* Boriss. was collected on limestones in the Aruk-Tau Range in Tadzhikistan at an altitude of 650 m: petals white (not yellow), with orbicular-rhombic lamina (not oblong), and well expressed claw; staminal scales ovate, shallowly dentate at apex (not fimbriate-dissected); ovary ovoid, with 5 narrow wings; style considerably twisted.

Subgenus 5. *Halimiphyllum* (Engl.) Boriss. — Sect. *Halimiphyllum* Engler in Abh. Akad. Berl. (1896) 11; Engl. Pflanzenfam. 19a (1931) 162. — *Grex Atriplicifolia* subgeneris *Euzygophyllum* M. Pop. in Byull. S.A.G. U. 11 (1925) 105. — Shrubs with simple leaves, covered when young with stellate hairs; flowers and fruits 4- or 5-merous; fruit a large winged capsule. — Caucasus, Turkmenistan (Kopet-Dagh Range), Iran, Pamir-Altai, Tien Shan (S.).

Series 1. *Tetraptera* Boiss. — Flowers and fruits 4-merous.

34. *Z. eurypterum* Boiss. et Buhse, Aufzähl. Pfl. Pers. (1860) 49; Boiss. Fl. cr. I, 912. — *Z. atriplicoides* ssp. *eurypterum* M. Pop. in Byull. S.A.G. U. 12 (1926) 119. — Ic.: M. Pop. l. c. tab. 7 (4) f. 24a.

Shrub 50–120 cm high, with elongate whitish branches; stipules short-triangular, obtuse; leaves simple, 2–3.5 cm long, 7–20 mm wide, oblong or ovate, with 5–7(10) mm long petioles. Pedicels ca. 15 mm long, declinate or erect; sepals and petals 4, obtuse; petals twice as long as calyx, ca. 10 mm; staminal scales as long as ovary; capsules (1.5)2–2.3 cm long, (2)3–3.5 cm wide, almost oblong-quadrate, subangular, 4-winged, deeply depressed, wings three to four times as broad as cell; seeds flattened, smooth, reniform, 8–10 mm long, ca. 5 mm wide, 1 in each cell. Fl. March–April, Fr. April–June. (Plate X, Figure 4.)

Mountain slopes, stony, pebbly, sometimes saline desert soils. — Centr. Asia: Mtn. Turkm. (SE at border with Iran), Kara K. (Mary district, Pul-i-Khatum, Lake Shor-Gel, Lake Yer-Oilan), Pam.-Al. (Kugitang Range, Shirabad valley). Gen. distr.: Iran (NE Iran, Afghanistan, Baluchistan). Described from Iran between Rudbar and Medzhil. Cotype in Leningrad.

Note. Many authors erroneously treated *Z. eurypterum* Boiss. as a synonym of *Z. atriplicoides*. In the USSR, *Z. eurypterum* occurs only in the above indicated place and is generally typical of the large deserts in the northeastern part of Iran.

190 35. *Z. gontscharovii* Boriss. sp. n. in Addenda XIII, 729. — *Z. atriplicoides* auct. non Fisch. — *Z. atriplicoides* var. *tetramerum* M. Pop. in Byull. S.A.G. U. 12 (1926) 119, p. p.

Shrub 60–120 cm high, with grayish sulcate bark, and yellow wood; stipules very small, triangular, broader than long, acute; leaves pale green, simple, 2–2.5 cm long, 10–15 mm wide, at first white-tomentose and densely stellate-hairy, later glabrescent, entire, thick, orbicular or ovate, obtuse at apex, sometimes hardly emarginate, with 3–7(10) mm long

petioles. Flowers solitary in axil, usually drooping, on 5–10 mm long pubescent pedicels; calyx green, stellate-hairy; sepals 4, two obovate, ca. 6 mm long, 4–5 mm wide, broadly white-margined, slightly tapering at base, emarginate, the other 2 sepals ovate, 4 mm long, ca. 3 mm wide, dilated at base, obtuse at apex, very narrowly white-margined; petals 4, yellowish-white when dry, 8–10 mm long, two petals 6–7 mm wide, cuneate-tapering at base, obtuse or hardly emarginate, the other 2 petals somewhat narrower; stamens 8, exserted from flowers, four stamens 14 mm long, four 12 mm; staminal scales ca. 4 mm long, oblong, crenate at margin of the upper part; ovary oblong, 4-locular, on short stalk; style filiform, three times as long as ovary; capsules subglobose, nearly as broad (2–2.5 cm) as long (2.3 cm), 4-winged, faintly depressed, wings pale yellow, parchment-colored, 1.5–2 times as broad as seeds; seeds usually solitary, large, 8–10 mm long, (3)5 mm wide, crescent-shaped, flattened, shiny brown-green and uniformly spongy at surface. Fl. March–May, Fr. May–June. (Plate X, Figure 3.)

Stony and loess slopes, red sandstones and gypsiferous strata at an altitude of 420–1,150 m, often together with pistachio. — Centr. Asia: Pam.-Al. (Babatag Range, Aruk-Tau Mountain, Ak-Tau, Kabadian, Kara-Tau Range and Alin-Tau in Kulyab district). Gen. distr.: Possibly in the adjacent parts of Afghanistan. Described from S. Tadzhikistan near Sangtud well and from Tabakchi Range. Type in Leningrad.

Note. This species differs from *Z. eurypterum* Boiss. by the size and shape of its capsule, the shape of the leaves, and its distribution area.

Series 2. Pentaptera Boriss. — Flowers and fruits 5-merous.

36. *Z. darvasicum* Boriss. sp. nova in Addenda XIII, 729. —
Z. atriplicoides auct. non Fisch.

Shrub 60–120 (?) cm high, with virgate hardly branching branches; bark pale gray, sulcate; stipules small, free, acute; young leaves oblong-elliptic, 191 stellate-hairy, almost subglabrous when fully developed, with hairs persistent mostly on petioles, mature leaves large, orbicular-elliptic, obtuse, emarginate, 2.5–3.5 cm long, with petioles winged, half as long as blade. Pedicels 3–5 mm long, elongating in fruit to 12–20 mm, densely pubescent, with persistent erect hairs; flowers 5-merous, 1 rarely 2 in axil; calyx of 5 unequal sepals, densely pubescent, two sepals ca. 6 mm long, ovate, broadly hyaline at margin, tapering at base, three sepals ca. 5 mm long, orbicular, narrowly hyaline-margin, obtuse, wide at base; petals white, ca. 9 mm long, obtuse at apex, cuneate at base; stamens 10, five of which 14 mm long, five slightly longer than petals; staminal scales one-third as long as filaments; ovary ovate, 5-locular; capsules on long thin erect pedicels, unripe fruits green, globose, as long as broad, with 5 broad wings; seeds ovate-oval, 7–9 mm long, 4–5 mm wide, with grayish shiny spongy coating. Fl. March–April, Fr. April–May.

Stony mountain slopes at altitudes of 1,400–2,000 m. — Centr. Asia: Pam.-Al. (Darvaza, along the Pyandzh River in Kala-i-Khumb district and along the Vanch River). Endemic. Distributed possibly in Afghanistan. Described from near Kala-i-Khumb. Type in Leningrad.

Note. *Z. darvasicum* is the tallest mountainous race occurring in the eastern part of the distribution area of the subgenus *Halimiphyl-lum* Boiss. Its 5-merous flowers resemble those of the Fergana and N. Pamir-Alai *Z. megacarpum* Boiss. from which it differs in habit, erect pubescent pedicels elongating in fruit, virgate branches and smaller fruits.

37. *Z. atriplicoides* Fisch. *Zygophyll.* (1834) 12, p. p.; Index I semin. horti Petrop. (1835) 41; Ldb. *Fl. Ross.* I, 486, p. p.; Boiss. *Fl. or.* I, 911, p. p.; M. Pop. in *Byull. S. A. G. U.* 12 (1926) 118, p. p.; O. and B. Fedch., *Perech. r. Turk.* I, 153, p. p.; Grossg., *Fl. Kavk.* III, 17. — *Z. atriplocoides* ssp. *typicum* M. Pop. l. c. p. p. — Ic.: M. Pop. l. c. tab. 7 (4) f. 24a. — Exs.: *Herb. Fl. Cauc.* No. 229.

Shrub, 50–115(120) cm high, strongly branching, with angular trunk 1–1.5(2.5) cm wide, branches thick, whitish, the older flexuose, with pale cinereous bark, wood yellowish; stipules very short, broader than long, acute, sometimes obtuse; leaves covered with stellate opposite hairs when young, spatulate-oblong, obovate or ovate, 1.5–3(4) cm long, 8–12 mm wide, gradually tapering to petiole one-third as long as blade, in young opposite, clustered when old, hardly acute at apex. Pedicels ca. 1 cm long, nearly as long as or slightly longer than calyx; sepals obovate or suborbicular, 192 obtuse, broadly membranous at margin, dorsally grayish, 5–6 mm long; petals 1.5–2 times as long as sepals, obovate, obtuse; stamens exerted; staminal scales small, oblong, serrate-dentate at margin and apex; capsules 1–1.5(2.5) cm long, 1–1.5(3) cm wide, globose or slightly broader at cross-section, 5-winged, wings 1.5–2 times as broad as cell, herbaceous-coriaceous; seeds 6–7 mm long, 1–2 in each cell, brown, covered with numerous gray papillae. Fl. April–May, Fr. May–June.

Dry slopes in foothills, hills, clayey, stony, pebbly and sandy soils. — Caucasus: S. Transc. (Nakhichevan, Araks valley); Centr. Asia: Mtn. Turkm. (Kopet-Dagh Range). Gen. distr.: Arm.-Kurd. (Kars). Described from Araks near Kulp. Type in Leningrad.

38. *Z. megacarpum* Boriss. sp. nova in *Addenda XIII*, 730. — *Z. atriplicoides* auct. non Fisch.

Shrub up to 2–2.5 m high; stem 2–3 cm in diameter, branches thick, sulcate, with grayish bark, wood yellowish; stipules short, broader than long, acuminate or acute, rapidly deciduous; leaves simple, whitish and densely stellate-hairy when young, later glabrescent, green, entire, spatulate, oval, ovate or orbicular, gradually tapering to petiole half as long as or nearly as long as blade, leaves at anthesis 1.5–2 cm long, short-petioled, the more developed leaves 3–5 cm long, 1–2.5 cm wide, obtuse at apex, opposite on young branches and clustered on old, sessile on short woody shoots 1–2.5 cm long, with traces of leaves of previous years. Flowers 5-merous, on 3–5 mm long pedicels; calyx green, sepals 5, three of which subglabrous, broadly ovate, ca. 6 mm long, ca. 4 mm wide, broadly yellowish-membranous at margin, emarginate, slightly tapering at base, two sepals sparsely stellate-hairy, oval, broad at base, acute at apex, (2) 4 mm long, 1.5 mm wide; petals golden-yellow, convex, 10–11 mm long, 6–7 mm wide, broadly ovate, gradually tapering at base, rounded at apex; stamens 10,

five of which nearly as long as petals and five ca. 13 mm long; anthers orbicular; staminal scales ovate, fimbriate at margin, one-fourth as long as filaments; ovary 5-locular, pentahedral, ovoid; style long, filiform, ca. 13 mm long, persistent in fruit; receptacle fleshy, capitate, thickened, not oblique; young fruit globose, usually solitary, rarely twin in axil, on thick short, ca. 5–10 mm long, usually drooping pedicels persistent to next year; capsules on very short stipe, 3–4.5 cm long, 3.5–4 cm wide, green, 193 brownish at middle, 5-winged, with thin membranous shiny wings three times as wide as seeds; seeds reniform or semi-orbicular, angular, 1, rarely 2–3, 8 mm long, 4 mm wide, the larger ca. 10(12) mm long, 5 mm wide, before ripening black-brown, shiny, with slightly tuberculate surface, acute. Fl. April, Fr. unripe May–June. (Plate X, Figure 5.)

Subgenus 6. *Pseudococcus* Boriss. in Addenda XIII, 731. — Fruit a bacciform capsule, wingless, oval.

Note. *Z. gobicum* Maxim., with its berrylike juicy fruit, refers to this subgenus and, possibly, even to an independent genus.

Series 1. *Melongena* Boriss. — Fruit a berrylike capsule, oval; leaflets 2 pairs, rarely 1 or 3; stipules scarious.

39. *Z. melongena* Bge. in Ldb. Fl. alt. II (1830) 104; Fisch. Zygophyll. 9; Ldb. Fl. Ross. 484; Maxim. Enum. pl. Mong. 124–125; Kryl., Fl. Zap. Sib. VIII, 1846; M. Pop. in Byull. S. A. G. U. 12, 109. — Ic.: Ldb. Ic. pl. Fl. Ross. tab. 218; M. Pop. l. c. tab. 6(3) f. 15.

Perennial; root woody; rootstock woody, cordlike, creeping; plants small, scabrous with elongate papilliform obtuse prickles, hairlike in the upper part of stem; stems strongly branching, with spreading branches 3–10 cm long, brittle at joints; stipules connate, the upper separate, whitish-scarious, broadly triangular-ovate to suborbicular, crenate at margins, ca. 2 mm long; leaves with flat-winged petioles 3–7 mm long, tapering at base and angustate at joints with leaflets, terminating in filiform white mucro; leaflets usually 2 pairs, rarely 3, sometimes 1 pair at the lower leaves, flat, dark green, obovate or broadly oval, rounded at apex, obliquely cuneate at base, 6–10(15) mm long, 2.5–5 mm wide. Flowers later drooping, mostly solitary in axil, rarely double, on pedicels (3)5–8 mm long; sepals elliptic, obtuse, broadly white-scarious at margin, 4–6 mm long, ca. 3 mm wide; petals as long as sepals, oblong-obovate, whitish, orange in the lower part (like stamens); stamens shorter than calyx, not exerted; staminal scales oblong-linear, crenate or splitting at apex, half as long as 194 filaments; fruit an oval wingless bacciform capsule slightly tapering above, 10–12 mm long, 4–6 mm wide, dehiscent; seeds ca. 3 mm long, densely covered with papillae, gray. Fl. July, Fr. July–September.

Rare, on solonchaks, gravels and stony soils. — W. Siberia: Alt. (Chuya steppe). Gen. distr.: Mong. (N. and W.). Described from Chuya steppe. Type in Leningrad.

Note. The specimens collected by B. K. Shishkin in the Chuya steppe have single flowers that became enlarged because of some mechanical

action; calyx increased to 9–10 mm long, with sepals white-membranous at margin, green, thickened [?]; petals 3 mm long, orbicular, short-clawed; filaments short, ca. 1 mm long, with large anthers up to 1.5 mm long; unripe fruit normal. There were normally developed flowers on one and the same specimen.

Genus. 841. **TRIBULUS*** L.
L. Gen. pl. ed. 5 (1754) 183

Calyx and corolla 5-merous; stamens 10, attached at base forming an annular disk, the 5 stamens alternating petals glandular at base; ovary sessile, style 1, with sulcate 5-lobed prolonged stigma; fruit pentagonal or spherical, separating into 5 fruitlets, furnished outside with spines and prickles or with pectinate-dentate marginal wings. Annual (or biennial) herbs, with paripinnate leaves and spreading stems.

There are 20 species in this genus which are spread throughout the Mediterranean region, particularly in the eastern part, and in S. Africa and America. Some species are widely spread as weeds in the tropical and temperate zones of the two hemispheres.

- 1. Flowers ca. 1.5 cm in diameter, pedicels ca. 1.5 cm long; leaflets long-hairy; fruitlets with pectinate-dentate marginal wings
..... 1. *T. macropterus* Boiss.
- + Flowers 1–1.2 cm in diameter, pedicels 4–10 mm long; leaflets glabrous above; fruitlets beset outside with large acute prickles, tubercles and bristles 2. *T. terrestris* L.

1. *T. macropterus* Boiss. Diagn. ser. I, 1 (1842) 61; Ej. Fl. or. I, 903. —

195 Annual, possibly biennial plants, with straight, woody root considerably thickened above; stems 10–40 cm long, rather thick, branching, spreading, white-hairy, like petioles and pedicels, appearing homentose, hairs of two kinds: sparse long-spreading and dense short-appressed; leaves paripinnate, opposite, 3–5 cm long, ca. 1.5 cm wide, with short petioles nearly as long as leaflets [stipules?] triangular-lanceolate, shorter than leaflets, densely covered with long, appressed hairs; leaflets 4–6 pairs, oblong, slightly asymmetrical, acuminate, 6–12 mm long, covered especially beneath, with long white appressed hairs. Flowers axillary, solitary, rather large, on ca. 1.5 cm long pedicels; sepals lanceolate, acuminate, 5–6 mm long; corolla yellowish; petals obovate, 6–8 mm long, ca. 4 mm wide; stigma prolonged, nearly as long as style; fruit subglobose, ca. 1.5 cm in diameter, of 4–5 fruitlets, outside profusely long-hairy, furnished with marginal wings, wings coraceous, pectinate-dentate, broader than fruit, appressed-short-hairy inside. Fl. April–June, Fr. May–July.

Sandy-clayey and sandy-gravelly plains and adjacent sandy river valleys. — Centr. Asia: Amu D. (Amu Darya river valley and the adjacent deserts in the region of Kelif-Kerkichi, Kyzyl-Ayak-Kerki). Gen. distr.: Iran. Described from S. Iran. Type in Geneva, cotype in Leningrad.

* From the Greek *Treis* — three and *bolos* — prickles, tooth; the fruits of one of the most widespread species (*T. terrestris*) have 2–4 acute dorsal prickles.

Note. It is uncertain whether the Russian plants should be referred to *T. persicus* Kralik (Ann. Sc. Nat. ser. 3, XI (1849) 27 or not. The differentiating characters between the two species are the relatively large style and stigma.

2. *T. terrestris* L. Sp. pl. (1753) 387; M. B. Fl. taur.-cauc. I, 311, III, 289; Ldb. Fl. Ross. I, 486; Boiss. Fl. or. I, 902; Shmal'g., Fl. I, 185; Aschers. et Graebn. Synopsis, VII, 230; Grossg., Fl. Kavk. III, 17; Kryl., Fl. Zap. Sib. VIII, 1869. — *T. bicornutus* Fisch. et Mey. in Bull. Soc. Nat. Mosc. XI (1838) 391. — *T. uniflorus* Nevski ex Bulavkina in Sorn. rast. SSSR. III (1934) 252. — Ic.: Hegi, III. Fl. V, 142; Corn. rast. SSSR. III, fig. 289, 291. — Exs.: G.R.F. No. 759, 759a; Fl. cauc. exs. No. 345, 345b.

Annual; root thin, annual, straight; stems 10–60 cm long, branching, spreading, covered like petioles and pedicels with hairs of two kinds — long-spreading and short-appressed, the whole plant appearing glaucescent; leaves paripinnate, opposite, 3–5 cm long, 1.5–2 cm wide, with small acute stipules; leaflets 6–8 pairs, oblong, 4–10 mm long, glabrous above, with long white appressed hairs beneath. Flowers axillary, solitary, small, few along stem, on 4–10 mm long pedicels; sepals ovate-lanceolate, acuminate, ca. 4 mm long, 1.5 mm wide; corolla yellowish; petals obovate, somewhat truncate, 5–7 mm long, ca. 3 mm wide; style short; fruit composed of 5 stellately disposed angular fruitlets, beset outside with large and acute 196 2 or 4 prickles, as well as tubercles and bristles. Fl. April–May, Fr. June–July. Under favorable conditions flowering throughout the summer.

Weedy and waste places, among crops, pebbly deposits and sands in river valleys. — European part: Bes., M. Dnp. (S.), Bl., V.-Don (S.), L. Don, Transv. (S.), L. V.; Caucasus: all plains and low mountains, in W. Transc. rarely; W. Siberia: Alt.; E. Siberia: Dau. (S.); Centr. Asia: in all regions except for the high mountains. Gen. distr.: Med., E., W. and S. Eur., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Dzu.-Kash., Mong., Jap.-Ch., widespread in Africa, America and in the tropical countries as an introduced weed. Described from S. Europe. Type in London.

Subfamily 4. **NITRARIOIDEAE** Engl. in E. P. Pflanzenfam. III, 4 (1890) 92; *ibid.* 19a (1931) 178. — Fruit an oval drupe (juicy in the Russian species), with ovoid-conical stone.

Genus 842. **NITRARIA** L.

L. Sp. pl. (1753) 102^o, nom.; Ej. Syst. Nat. ed. 10 II (1759) 1044; Kom. in Tr. B. S. XXIX, I (1908) 151; Bobrov in Sov. Bot. XIV, 1 (1946) 24

Sepals 5, fleshy, connate at base, persistent in fruit; petals the same number as sepals, convex, cap-shaped above; stamens 15–10, 5 opposite sepals, 2 or 1 [whorl] opposite petals; ovary free, sessile, oblong, 3-locular, with 1 ovule in each cell; stigma ovate, hardly 3-partite; drupe bacciform, juicy, oval, stone ovoid-conical, 1-seeded; seeds pendulous, with scarious

coating and exalbuminous embryo. Shrubs 0.5–2 m high, sometimes spinous; leaves stipulate, alternate, simple, fleshy; flowers yellowish or white, short-pedicel, forming loose axillary inflorescences.

Eight species are included in this genus, three of which occur in the USSR, one in Australia, three in Central Asia and one in Africa and Arabia which reaches southern Palestine.

1. Drupe small, with dark blue juice, stone small, ovate-obtuse; shrub 0.5–1 m high; leaves obovate, small (in the mountainous regions of Central Asia, Kazakh hilly country, and also in the mountainous regions of S. Siberia) 1. *N. sibirica* Pall.
- + Drupe larger, with pale red juice, stone larger, ovate, acuminate . . . 2.
2. Leaves oblong-spatulate or obovate (in the desert regions of the Aral-Caspian area spreading through valleys to the borders of Soviet Central Asia, as well as in W. Transcaucasia and the Crimea) 2. *N. schoberi* L.
- 97 + Leaves linear-spatulate, longer, gradually tapering at base; inflorescence thinner (west maritime Turkmenistan and on Apsheron) 3. *N. komarovii* Iljin et Lava.

1. *N. sibirica* Pall. Fl. Ross. I (1784) 80; Bobrov in Sov. Bot. XIV, 1, 26. — *N. Schoberi* Ldb. Fl. alt. II (1830) 202; Turcz. Fl. baic.-dah. I, 439; Kryl., Fl. Zap. Sib. VIII, 1851. — *N. Schoberi* α . *sibirica* DC. Prodr. III (1828) 456. — *N. Schoberi* β . *sibirica* Pall. ex Kom. in Tr. B. S. XXIX, 1 (1908) 155. — Ic.: Pall. l. c. tab. L, A; Gmel. Fl. Sib. II, tab. XCVIII.

Shrub, ca. $\frac{1}{2}$ m and up to 1 m high, with whitish-gray bark, profusely branching and usually spinous; stipules small, white-scarious, persistent; leaves obovate, small; drupe small, with dark blue juice, stone small, ovate, obtuse. Fl. May–June, Fr. August.

Rubbly, often solonetzic soil in the northern deserts, foothills and low mountain horizons. — W. Siberia: U. Tob. (upper reaches of the Tobol River), Irt. (S.), Alt. (W. and S.); E. Siberia: Ang.-Say. (upper Yenisei and Abakan, also the basin of upper Angara); Centr. Asia: Ar.-Casp. (N. and E.), Balkh., Dzu.-Tarb., T. Sh. (northern part, west of Talas). Gen. distr.: Dzu.-Kash., Mong. Description based on Steller's collections from Barguzin district. Type lost?

2. *N. schoberi* L. Syst. Nat. ed. 10, II (1759) 1044; Shmal'g., Fl. I, 185; Bobrov in Sov. Bot. XIV, 1, 27; Ldb. Fl. Ross. I, 505, p. p.; Boiss. Fl. or. I, 919; Grossg., Fl. Kavk. III, 17. — *N. Schoberi* var. *caspica* Pall. Fl. Ross. I (1784) 79; Kom. in Tr. B. S. XXIX, 1, 155. — *N. Schoberi* β . W. Sp. pl. II (1800) 858. — *N. caspica* W. nom. ex Ldb. l. c. — *N. Schoberi* β . *caspica* DC. Prodr. III (1828) 456. — Ic.: Pall. l. c. tab. L, B; Jaub. et Sp. Illustr. III, tab. 295.

Shrub, usually more than 1 and up to 2 m high, sometimes spinous; leaves large, oblong-spatulate or obovate; drupe larger, with pale red juice, stone larger, ovate, acuminate. Fl. May, Fr. August.

Clayey and sandy, usually solonetzic soil in desert plains, also in rubbly deposits in the low mountain belt. — European part: L. V. (up to the line

Ergeni-Krasnoarmeisk-Uralsk in the north), Crim. (Sudak); Caucasus: Cisc.(E.), Dag., E. and S. Transc., W. Transc. (Kars, Kagyzman); W. Siberia: U. Tob. (south of the line Chkalov-Orsk and in the upper reaches of the Tobol River), Irt. (south, in the upper reaches of the Ishim River and to the west of Karasuk in the Kulunda Steppe); Centr. Asia: Ar.-Kasp., Balkh., Kyz. K., Kara K., Amu D., Syr D. (up to and including Alai valley), Pam.-Al. (Ishkashim). Gen. distr.: Dzu.-Kash.(W.), Iran. Described from the Lower Volga. Type in London.

- 198 3. *N. komarovii* Iljin et Lava in zhurn. Priroda, 1944, No.5-6, 117, f.1. — *N. Schoberi* var. *polygama* Trautv. in Tr. B. S. I (1871) 25. — Ic.: Priroda, l. c.

Shrub, quite similar to the preceding species, differs by being less spreading and more elegant and delicate, with narrower and longer linear-spatulate leaves, gradually tapering at base, and thinner inflorescence. Fl. May, Fr. August.

Maritime saline clayey and sandy-clayey deserts. — Caucasus: E. Transc. (Apsheron near Balakhany); Centr. Asia: Kara K. (W. Turkmenistan, in the area adjacent to Krasnovodsk Gulf, Cheleken). Endemic. Described from the vicinity of Krasnovodsk. Type in Leningrad.

Family LXXXIII. **RUTACEAE*** JUSS.

Flowers bisexual or abortive-unisexual, regular or irregular; sepals 4-5, imbricate in aestivation; petals 4-8, inserted at glandular disk; stamens 4 to many, free or monodelphous-polydelphous; ovary superior, tri- to many-celled; ovules 1 to many in each cell; placenta central; style 1; fruit a capsule, drupe, samara or berry. Plants more or less covered with glands, with exstipulate leaves.

Key to Genera

1. Perennial herbs, with imparipinnate (median) leaves and irregular pinkish large flowers 845. *Dictamnus* L.
- + Flowers regular 2.
2. Flowers with yellow tinge, rarely red, bisexual; fruit a capsule; herbs or semishrubs 3.
- + Flowers greenish, unisexual and dioecious, or white, sometimes with purple tinge and usually bisexual; fruit a samara, drupe or berry; shrubs and trees 4.
3. Flowers 4-merous except for the first central; leaves 2-3-pinnatisect 843. *Ruta* L.
- + Flowers 5-merous; leaves entire or 3-6-sect 844. *Haplophyllum* A. Juss.
4. Flowers greenish, unisexual, dioecious; stamens 4-5; fruit a samara or drupe 5.

* Treatment by A.I. Vvedenskii.

- + Flowers white, sometimes with purple tinge, usually bisexual; stamens 8 to many; fruit bacciform; cultivated plants 6.
- 5. Leaves simple, wintering; spreading dioecious shrub 846a. *Skimmia* Thunb.
- 199 + Leaves ternate; fruit a samara; cultivated shrub ★*Ptelea* L.
- + Leaves imparipinnate; fruit a drupe with 5 stones; tree growing wild in the Far East 846. *Phellodendron* Rupr.
- 6. Leaves ternate, deciduous; stamens 8–10; fruit densely hairy ★*Poncirus* Raf.
- + Leaves simple, persistent; stamens 18 to many; fruit glabrous . . . 7.
- 7. Ovary 3–7-locular, with 2 ovules in each cell . . . ★*Fortunella* Swing.
- + Ovary 8-to many-celled, with 4–8 ovules in each cell ★*Citrus* L.

Subfamily 1. **RUTOIDEAE** Engl. in E. P. Pflzfam. III, 4 (1896) 110. — Flowers 4–5-merous, bisexual; stamens twice as long as petals; fruit a capsule.

Genus 843. **RUTA** * L.

L. Sp. pl. (1753) 383; Gen. pl. ed. 5 (1754) 180

Flowers regular, bisexual, 4-merous, sometimes the first (central) flowers 5-merous; sepals 4-(5); petals 4-(5), yellow, long-clawed, boot-shaped; stamens 8–(10), free, with glabrous filaments; style 1, with unthickened stigma; ovules 8–12 in each cell; capsule 4–(5-) locular, dehiscent from the inner side of apex. Perennial herbs and semishrubs, with pinnatisect leaves.

1. *R. graveolens* L. Sp. pl. (1753) 383, p. p.; Ldb. Fl. Ross. I, 490; Boiss. Fl. or. I, 921; Rouy et Fouc. Fl. Fr. IV, 136. — *R. hortensis* Mill. Gard. dict. ed. 8 (1768) No. 1; Aschers. et Graebn. Syn. VII, 242. — Ic.: Kom., Sbor, sushka i razved. lekarstv. rast. (1917) fig. 65.

Perennial; completely glabrous, glaucescent or glaucous; stems more or less woody at base, branching in inflorescence, 20–50 cm high; lower and median leaves long-petioled, triangular-ovate, 2–3-pinnatisect into spreading segments, segments nearly subentire, narrowly involute at margin, the lateral linear-lanceolate or oblanceolate, acute or obtuse, the terminal oblong-oblanceolate, acute or obtuse, apical segment obovate or oblong-obovate, truncate or short-acuminate at apex, the principal segments long-petioluled, the others sessile; uppermost leaves sessile, pinnatisect, with narrower segments. Inflorescence loose, corymbiform; bracts linear; sepals triangular, acute, 2–2.5 mm long; petals abruptly tapering to claw, entire or finely toothed, more or less curly at margin, 6–9 mm long; capsules with obtuse cells, 5–7(9) mm wide. June–July. (Plate XI, Figure 2).

Stony and rubbly slopes. — European part: Crim. In the Ukraine mostly cultivated.

Economic importance. Officinal plants. Important as a source of volatile oil.

* Name used by Latin authors for this plant.

Note. The wild rue of the Crimea and the cultivated rue apparently belong to different species whose precise delimitation and nomenclature could be established only after monographic study of all the related Mediterranean species.

R. montana L. is reported for the border areas with Turkey (Ldb. Fl. Ross. I (1867) 490); it is distinguished by its narrower, linear leaf segments and smaller flowers. This record has not been confirmed by later collections.

Genus 844. **HAPLOPHYLLUM*** A. Juss.

A. Juss. in Mem. Mus. Hist. Nat. XII (1825) 464, tab.17, No.10

Flowers regular, bisexual; sepals 5; petals 5, clawed, usually yellow, rarely red with yellow margins; stamens 10, free or connate at base, more or less pubescent, rarely glabrous; style 1, with capitate stigma; ovary with 2 to few ovules in each cell, cell (and capsule) with or without appendages at apex; capsule 2–5-locular, dehiscent from the inner side of apex or indehiscent, with falling or inseparate cells. Perennial herbs and semi-shrubs, with entire or 3–(6-)sect leaves.

Economic importance. The plants contain essential oil in all their parts.

- | | | | |
|--------|---|-----|---|
| 1. | Ovary (2)3(4)-locular | 1. | <i>H. dauricum</i> (L.) G. Don. |
| + | Ovary 5-locular | 2. | |
| 2. | Cells of capsule indehiscent; robust paniculate-corymbiformly branching herbs with large entire leaves | 3. | |
| + | Cells of capsule dehiscent | 5. | |
| 3. | Petals 9–12 mm long; capsule densely covered with rod-shaped tubercles | 30. | <i>H. latifolium</i> K. et K. |
| + | Petals 3–6 mm long; capsule tuberculate | 4. | |
| 203 4. | Sepals free nearly to base, triangular, acute; petals (3)3.5–4(5.5) mm long; inflorescence with pubescent branches | 32. | <i>H. perforatum</i> (M. B.) K. et K. |
| + | Sepals free for $(1\frac{1}{2})\frac{3}{4}$, ovate-triangular, obtuse; petals (4)5–6 mm long; inflorescence with glabrous branches | 31. | <i>H. acutifolium</i> (DC.) G. Don. |
| 5. | Ovary with 4 or more ovules in each cell; petals ovate, broadly ovate or oblong | 6. | |
| + | Ovary with 2 ovules in each cell | 11. | |
| 6. | Plants covered with soft spreading hairs; ovary with 6–12 ovules in each cell | 2. | <i>H. pedicellatum</i> Bge. |
| + | Plants glabrous or with curly hairs; ovary with 4–6 ovules in each cell | 7. | |
| 7. | Semishrub; sepals deciduous | 8. | |
| + | Herbaceous plants; sepals persistent | 9. | |
| 8. | Petals yellow; capsule tuberculate | 6. | <i>H. bucharicum</i> Litv. |
| + | Petals red, yellow at margin; capsule glandular-dotted | 7. | <i>H. affine</i> (Aitch. et Hemsl.) Eug. Kor. |

* From the Greek *aploos* – simple, and *phyllon* – leaf; in most species of the genus the leaves are entire.



PLATE XI. 1—*Dictamnus gymnostylis* Stev.; 2—*Ruta graveolens* L.

9. Leaves gradually and long tapering to petiole, not dense below inflorescence 5.. *H. bourgaei* Boiss.
10. Capsule glabrous, without appendages 3. *H. suaveolens* (DC.) G. Don.
- + Capsule more or less pubescent, with appendages 4. *H. ciliatum* Gris.
11. Filaments completely free 12.
- + Filaments connate at base 25.
12. Leaves cordate at base, sessile, fleshy, acute 8. *H. kowalenskyi* Stschegl.
- + Leaves sessile or petiolate, gradually or rapidly tapering at base, not cordate 13.
13. Median leaves broadly oblong or obovate, rapidly tapering at base 14.
- + Median leaves linear, oblanceolate or oblong-lanceolate, gradually tapering at base 15.
14. Herbaceous plants, pubescent, glandulose-tuberculate; petals pale yellow, oblong-lanceolate; capsule with tuberculate appendages 27. *H. robustum* Bge.
- + Semishrub, completely glabrous, dotted with glands; petals yellow, broadly oblong-ovate; capsule without appendages 9. *H. eugenii korovinii* Pavl.
15. Semishrubs, leaves crenate with glands more or less protruding 16.
- 204 + Leaves completely entire, dotted with glands 18.
16. Capsule with small tuberculate appendages; petals more or less pubescent dorsally 10. *H. multicaule* Vved.
- + Capsule with well developed appendages; petals glabrous 17.
17. Petals pale yellow; sepals pubescent; capsule nearly smooth or sparsely tuberculate; glaucescent or glaucous, strongly branching plants 11. *H. ramosissimum* Vved.
- + Petals yellow; sepals glabrous; capsule densely tuberculate; green or glaucescent plants, usually branching at base and in inflorescence 12. *H. obtusifolium* Ldb.
18. Semishrub, with slightly fleshy canaliculate-linear leaves, entire or dissected into segments 19.
- + Leaves not fleshy, flat, linear-oblanceolate, oblanceolate, or oblong, entire or dissected 22.
19. Petals ovate or broadly ovate, 8–10 mm long; filaments eglandulose; capsule tuberculate 14. *H. dshungaricum* Rubtz.
- + Petals elliptic, oblong-elliptic or oblong-ovate, 3.5–6 mm long; filaments glandular; capsule dotted-glandular 20.
20. Leaves entire 15. *H. foliosum* Vved.
- + Leaves 3-sect. 21.
21. Leaves 3(6)-sect from the middle; capsule glabrous, with tuberculate appendages or without . . . 16. *H. tenuisectum* Lincz. et Vved.
- + Leaves 3-sect from base; capsule pubescent, with corniculate short appendages 17. *H. leptomerum* Lincz. et Vved.
22. Plant glabrous except in upper part of stem and inflorescence; ovary glabrous 18. *H. tenue* Boiss.
- + Plant almost entirely pubescent; ovary (and capsule) pubescent 23.

23. Green semishrub; capsule with long hamately curved appendages . . .
 19. *H. ciscaucasicum* Grossh. et Vved.
 + Glaucous herbaceous plants; capsule without appendages or with
 short erect ones 24.
 24. Sepals deciduous; capsule with appendages; leaves entire
 20. *H. villosum* (M. B.) G. Don.
 + Sepals persistent; capsule without appendages; leaves 3-sect
 except for the lowermost 21. *H. schelkovnikovii* Grossh.
 25. Filaments almost completely connate; semishrub
 13. *H. monadelphum* Afan.
 + Filaments connate at base; herbs 26.
 205 26. Petals pale yellow, usually dorsally pubescent 27.
 + Petals yellow, glabrous 28.
 27. Sparingly short-pubescent or glabrous plants; capsule 3–3.5 mm
 wide 29. *H. versicolor* Fisch. et Mey.
 + Plant with long curly hairs, nearly villous in inflorescence; capsule
 ca. 4 mm wide 28. *H. ferganicum* Vved.
 28. All leaves always entire 29.
 + Median leaves 3(5)-sect (very rarely all leaves entire, if so then
 lower leaves with petioles more than half as long as blade) 30.
 29. Plants with prominent glands; stems branching; inflorescence
 loose; capsule with short appendages, 4–5 mm wide
 25. *H. bungei* Trautv.
 + Plant dotted-glandular; stems nearly simple, branching above or
 only in inflorescence; inflorescence dense; capsule without
 appendages, 3–3.5 mm wide 26. *H. popovii* Eug. Kor.
 30. Green plants, covered with prominent glands; filaments distinctly
 connate at base 24. *H. alberti regellii* Eug. Kor.
 + Glaucous and glaucous plants, dotted with glands; filaments . . .
 connate at base, nearly free 31.
 31. Petals 5–5.5(8) mm long, gradually tapering to claw; style 2–2.5 mm
 long; capsule without appendages; lowest and uppermost leaves
 entire 22. *H. dubium* Eug. Kor.
 + Petals 7–8.5 mm long, rapidly tapering to claw; style 3–3.5 mm long;
 capsule with tuberculate appendages; all cauline leaves except for
 the lowermost 3-sect 23. *H. vvedenskyi* Nevski.

Section 1. PEGANOIDES Spach in Jaub. et Spach, III, pl. or. III
 (1847–1850) 84 (pro subgen.).— Ovary (2)3(4)-locular, 2 ovules in each
 cell; capsule dehiscent.

1. *H. dauricum* (L.) G. Don, Gen. Syst. I (1831) 781; Ldb. Fl. Ross.
 I, 492; Turcz. in Bull. Soc. Nat. Mosc. XV (1842) 636; Spach in Jaub.
 et Sp. III, pl. or. III (1847–1850) 84; Spach in Ann. Sc. Nat. Bot. 3
 sér. XI (1849) 190.— *Peganum dauricum* L. Sp. pl. (1753) 445.—
Ruta dahurica DC. Prodr. I (1824) 712; Kryl., Fl. Zap. Sib. VIII,
 1853.— Ic.: Trautv. Pl. Imag. et descr. (1844) tab. 29.— Exs.: G. R. F.
 No. 1013.

Perennial; green, glabrous, multicaulescent plants, punctately glandular; stems thin, herbaceous, usually simple, glabrous or sparingly and finely pubescent, densely leafy, 10–25 cm high; leaves sessile, tapering gradually at base, finely crenate, the lower oblong-ob lanceolate or oblong, obtuse, reduced, the median and upper leaves oblanceolate or lanceolate, acute. Inflorescence few-flowered, corymbiform, with more or less pubescent
 206 pedicels; bracts linear; sepals deciduous, triangular-ovate, acute, more or less ciliate, ca. 1 mm long; petals yellow, glabrous, oblong-elliptic, oblong-lanceolate or lanceolate, rapidly tapering to short ($1\frac{1}{2}$ to 1 mm long) claw, 6–8 mm long; filaments free, eglandulose, more or less tapering at apex, more or less pubescent below; style glabrous; ovary on short stalk, glabrous, nearly smooth, without appendages; capsules dehiscent, short-pedicelled, glabrous, finely dotted-glandular, 3–5 mm wide. June–July.

Steppes, rubbly and stony slopes. — W. Siberia: Alt.; E. Siberia: Ang.-Say., Dau. Gen. distr.: Mong. Described from Siberia without exact locality. Type in London.

Section 2. POLYOON Vved. — § Sexovulata et § Quadriovulata Boiss. Fl. or. I (1867) 923. — Ovary 5-locular, 4–12 ovules in each cell; capsule dehiscent.

2. *H. pedicellatum* Bge. in Boiss. Fl. or. I (1867) 925; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Syr- i Amu-dar'i, II (1916) 83. — *H. hirsutum* Rgl. et Schmalh. in Izv. obshch. Lyub. Est. Antr. i Etnogr. XXXIV, 2 (1882) 17; Eug. Kor. l. c. — *H. pilosum* Franch. in Ann. Sc. Nat. Bot. 6 sér. XV (1883) 248, tab. 13. — *Ruta pilosa* O. Ktze. in Tr. B. S. X (1887) 177. — *R. hirsuta* O. Ktze. l. c. — *R. pedicellata* Aitch. et Hemsl. in Trans. Linn. Soc. 2 sér. III (1888) 45. — *H. pedicellatum* var. *villosum* Zinger in Tr. Yur'evsk. Bot. Sada. II (1901) 163. — *H. sublanatum* Freys et Sint. in Bull. Herb. Boiss. 2 sér. IV (1904) 36. — Ic.: Franch. l. c. — Exs.: Herb. Fl. As. Med. No. 279.

Perennial; plants green or glaucescent, herbaceous, with spreading soft hairs, sometimes very densely pubescent; stems ascending, rather robust, with inconspicuous glands, simple or branching, usually with reduced axillary branches, densely leafy, 20–50 cm high; leaves entire, very rarely 3-sect, dotted with glands, oblong-lanceolate or lanceolate, rarely oblong, tapering to long petiole usually as long as blade, obtuse or acute. Inflorescence corymbiform, dense; bracts few, linear; flowers pedicelled; sepals persistent, ovate, obtuse, villous, ca. 1.5 mm long; petals yellow, often reddening at apex, broadly ovate, obtuse, very short-clawed, (7)8–9(10) mm long, 6–7 mm wide; filaments free, subequal, glandular, gradually tapering from broad base, barbate inside near middle, nearly half as long as petals; style glabrous; ovary sessile, tuberculate, with short appendages; capsules dehiscent, subsessile, tuberculate, more or less pubescent or glabrous, with appendages ca. 5 mm wide. May–June.

207 Clayey, rarely sandy deserts, slopes with fine soil at foothills in the low mountain belt. — Centr. Asia: Syr D., Kyz. K. (S.), Kara K. (S.), Pam.-Al., Mtn. Turkm. Gen. distr.: Iran, Afghanistan. Described from Iran (Khorosan). Cotype in Leningrad.

Note. The plants from S. Tadzhikistan (Decliv. orient. planit. elevatae inter Kabadian et fl. Wachs, A. Regel; Linchevskii and Maslennikova. Watershed of Kara-Tau Range near Sardoba-Kutal pass) should be further studied, as differing from the typical *H. pedicellatum*. The former population has capsules without appendages and the latter capsules nearly without tubercles [?].

3. *H. suaveolens* (DC.) G. Don, Gen. syst. I (1831) 780 (quoad pl. tauricam); Ldb. Fl. Ross. I (1842) 491 (quoad pl. tauricam).—*Ruta suaveolens* DC. Prodr. I (1824) 711 (quoad pl. tauricam).—*R. thesioides* Fisch. ex DC. l. c. 712.—*H. thesioides* G. Don, l. c.; Ldb. l. c. 492; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Amu- i Syr-dar'i. II (1916) 83.—*H. congestum* Spach in Jaub. et Sp. III. pl. or. III (1847–1850) 77, tab. 261; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 178; Boiss. Fl. or. I, 925.—*H. tauricum* Spach in Jaub. et Sp. l. c. 79; Spach in Ann. Sc. Nat. l. c.; Grossg., Fl. Kavk. III (1932) 19.—*Ruta taurica* Nym. Syll. fl. Eur. (1854–1855) 220.—*R. liniifolia* auct. Fl. Ross. p. p.—Ic.: Jaub. et Spach, l. c. (sub *H. congesto*).—Exs.: Dorfler, Herb. Norm. No. 4619 (sub *R. taurica*).—

Perennial; green or glaucescent herbaceous plants; stems few, ascending below, usually simple, with inconspicuous glands, densely leafy, glabrous below, more or less crisp-hairy above like branches of inflorescence and pedicels, 10–30 cm high; leaves entire, sessile, oblanceolate or oblong-oblanceolate, rarely oblong-lanceolate, long-tapering at base, acute, more or less crisp-hairy or glabrous, dotted with glands, the lower becoming approximate below inflorescence, the upper reduced. Inflorescence corymbiform, very dense; bracts few, foliaceous, sepals persistent, ovate or oblong, more or less crenate, acute or obtuse, glabrous or pubescent, often ciliate, 2–2.5 mm long; petals yellow, glabrous, ovate or rarely broadly oblong, obtuse, with very short claw, 7(8)–11 mm long, long persistent; filaments free, subequal, glandular, gradually tapering from the dilated base, pubescent inside at the lower one-third to two-fifths, barbate-pubescent at base, half to two-thirds as long as petals; style glabrous; ovary sessile, glabrous, tuberculate, without appendages; capsules subsessile, tuberculate, sometimes papilliform-tuberculate above, without appendages, glabrous, 4–5 mm wide. May–August.

Stony slopes, limestone outcrops.—European part: Crim.; Caucasus: W. Transc. Gen. distr.: As.–Min. Described from the Crimea and Bessarabia. Type in Paris.

208 Note. Study of the original specimens of *E. thesioides* revealed that it differs in no way from *H. suaveolens*. Boissier's report that its ovary bears appendages is erroneous. The plant probably occurs in the Crimea, where it was collected by Pallas, and Mangupkal stands for Mangyshlak. At any rate, in spite of the abundant recent collections near Mangyshlak and Ust-Urt, this plant has not been found there.

4. *H. ciliatum* Gris. Spic. fl. Rumel. I (1843) 130.—*H. Biebersteinii* Spach in Jaub. et Sp. III, pl. or. III (1847–1850) 79; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 178.—*H. Besseri* Spach, l. c.—*Ruta suaveolem* DC. Prodr. I (1824) 711 (quoad pl. bessarabicam).—

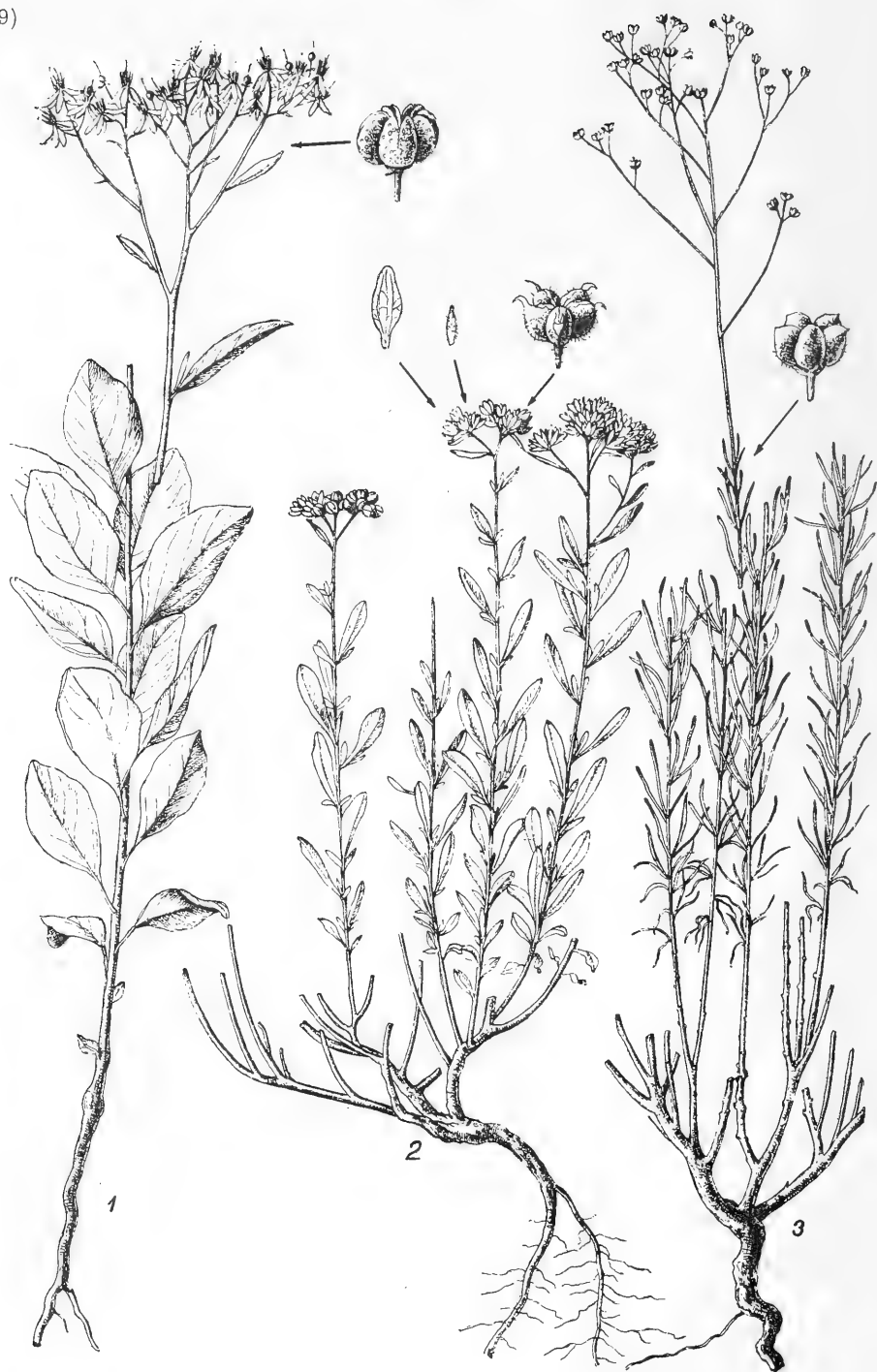


PLATE XII. 1 - *Haplophyllum popovii* Eug. Kor.; 2 - *H. villosum* (M.B.) G. Don.; 3 - *H. leptomerum* Lincz. et Vved.

H. suaveolens G. Don, Gen. syst. I (1831) 780 (quoad pl. bessarabica-
cam); Ldb. Fl. Ross. I (1842) 491 (quoad plantas e Rossia australi);
Boiss. Fl. or. I, 927, Aschers. et Graebn. Syn. VII (1915) 248. —
R. Besseri Nym. Syll. fl. Eur. (1854–1855) 219. — Ic.: Trautv. Pl.
imag. et descr. (1844) tab. 26 (sub *H. suaveolente*). — Exs.: Dörfler,
Herb. Norm. No. 5243 (sub *R. suaveolente*). —

Perennial; green or glaucescent herbaceous plants; stems few, more
or less ascending at base, usually simple, with inconspicuous glands, densely
leafy, together with inflorescence branches and pedicels more or less densely
crisp-hairy, 15–40 cm high; leaves entire, sessile, oblanceolate or lance-
olate, rarely oblong-oblanceolate or oblong, acute, more or less pubescent,
dotted with glands, the lower becoming approximate below inflorescence,
the upper reduced. Inflorescence corymbiform, more or less dense; bracts
few, foliaceous, sepals persistent, oblong or triangular-lanceolate, acute,
more or less villous, 1.5–2 mm long; petals yellow, glabrous or dorsally
pubescent, ovate or broadly oblong, obtuse, short-clawed, 7–10 mm long,
long persistent; filaments free, subequal, glandular, gradually tapering from
the dilated base, half to three-fourths as long as petals; style glabrous;
ovary sessile, pubescent, tuberculate, with appendages; capsules subsessile,
tuberculate, more or less pubescent, with short appendages, 4–5 mm wide.
June–August.

Slopes of fine calcareous soil, mostly limestone outcrops. — European
part: Bl., L. Don, Bess. Gen. distr.: Bal., Centr. Eur. Described from
Rumelia. Type in Vienna.

Note. Very close to the preceding species, both of which should be
critically studied.

211 5. *H. bourgaei* Boiss. Fl. or. I (1867) 928; Grossg., Fl. Kavk. III, 19.

Perennial; green herbaceous plant; stems few, ascending at base, some-
times colored below, short-hairy, rarely subglabrous, inconspicuously gland-
ular, usually simple, 15–30 cm high; leaves entire, oblanceolate, rarely
lanceolate, gradually long-tapering to petiole, acute, glabrous, dotted with
glands, glaucescent beneath. Inflorescence corymbiform, dense, with densely
pubescent branches and pedicels; bracts linear or linear-lanceolate, few;
sepals persistent, triangular-ovate, acute, villous, 1–1.5 mm long; petals
yellow, dorsally more or less pubescent or rarely glabrous, broadly ovate
or broadly oblong, obtuse, concave, very short-clawed, 7–8 mm long, long
persistent; filaments free, subequal, glandular, half to three-fourths as long
as petals, gradually tapering from the slightly dilated base, barbate-
pubescent at the lower third; style glabrous; ovary sessile, tuberculate,
with appendages; capsules dehiscent, subsessile, more or less pubescent,
rarely glabrous, tuberculate, with short appendages, 4–5 mm wide. June–
August.

Stony slopes in the central mountain zone. — Caucasus: S. Transc.
Gen. distr.: Arm.–Kurd. Described from Gyumyushkan. Type in Geneva.

Note. The specimens from Borzhomi are distinguished by the absence
of appendages on capsules. They should be further studied.

6. *H. bucharicum* Litv. in Tr. Bot. Muz. Ak. Nauk. VII (1910) 73. —
H. nigripes Nevski in Tr. Bot. Inst. AN SSSR, 1 ser. IV (1937) 235,
f. 4. — Ic.: Nevski, l. c.

Perennial; green or glaucescent multicaulescent, semishrub, more or less crisp-hairy or glabrous; stems thin, ascending, inconspicuously glandular, usually simple, often dark violet below, 15–35 cm high; leaves slightly fleshy, lanceolate or usually oblanceolate or obovate, dotted with glands, entire, obtuse or acute, subsessile, infrequently petioles half as long as blade. Inflorescence paniculate-corymbiform, loose, few-flowered; bracts linear or lanceolate; sepals deciduous, oblong or ovate, obtuse, glabrous or often villous-ciliate, 1–1.5 mm long; petals yellow, glabrous, broadly ovate, obtuse, concave, very short-clawed, 6–8 mm long; filaments free, subequal, eglandulose, half to three-fourths as long as petals, gradually tapering from the somewhat dilated base, glabrous or often barbate at the middle; style thick, glabrous; ovary short-stalked, glabrous, tuberculate; capsules dehiscent, on ca. 1 mm long stipe, glabrous, tuberculate, sometimes tubercles stalked, with tuberculate appendages, 4–5 mm wide. May–June.

Variegated rock outcrops. — Centr. Asia: Pam.-Al. (southwestern part). Endemic. Described from Sairob. Type in Leningrad.

- 212 7. *H. affine* (Aitch. et Hemsl.) Eug. Kor. in *Izv. Inst. pochv. i geobot. S.A.G.U.* I (1925) 22). — *Ruta affinis* Aitch. et Hemsl. in *Trans. Linn. Soc.* 2 sér. III (1888) 45, tab. V, f. 1–10. — *H. badghysi* Eug. Kor. in *Pochv. i bot.-geogr. issl. bass. rr. Syr- i Amu-dar'i*, II (1916) 61, tab. 14. — Ic: Aitch. l. c.; Eug. Kor. l. c.

Perennial; green, completely glabrous semishrub; stems few, thin, herbaceous, usually branching, inconspicuously glandular, 20–30 cm high; leaves entire or slightly crenate-dentate, obtuse, lower leaves oblong or oblanceolate, gradually tapering nearly from apex, subpetiolate, the upper leaves linear. Inflorescence paniculate-corymbiform, loose, [leafless?]; bracts linear, few; sepals deciduous, ovate, obtuse, ca. 1.5 mm long; petals red, yellow at margin, broadly elliptic, very short-clawed, 7–8 mm long; 5–6 mm wide; filaments free, subequal, glandular, glabrous or ciliate near the middle, abruptly tapering above, three-fourths as long as petals; style glabrous; ovary stalked, glabrous, smooth, with appendages; capsules dehiscent, on ca. 1 mm long stipe, glabrous, densely dotted-glandular, ca. 5 mm wide. May.

Variegated rock outcrops. — Centr. Asia: Mtn. Turkm. (Bad-Khyz). Gen. distr.: Afghanistan. Described from the Gerirud River valley. Cotype in Leningrad.

Section 3. *OLIGOON* Vved. — § *Biovulata ovulis collateralibus* Boiss. Fl. or. I (1867) 983. — Ovary 5-locular, with 2 ovules in each cell; capsule dehiscent.

8. *H. kowalenskyi* Stschegl. in *Bull. Soc. Nat. Mosc.* XXIV, 2 (1851) 467, tab. 13, f. 1; Grossg., Fl. Kavk. III, 20. — *H. subcordatum* Bge. in Boiss. Fl. or. I (1867) 932. — Ic.: Stschegl. l. c. — Exs.: Pl. or. exs. No. 267.

Perennial; glaucous herbaceous plants, punctate-glandular; stems solitary or few, robust, simple or slightly branching above, erect or the lateral ascending, very densely leafy, whitish, glabrous, leafless below

inflorescence, 20–30 cm high; leaves entire, fleshy, glabrous, the lower and upper reduced, sessile, oblong or oblong-lanceolate, cordate at base, acute, with thick midrib. Inflorescence terminal at stem and branches, corymbiform, very dense, with more or less densely pubescent branches and pedicels; bracts nearly absent; sepals persistent, ovate, acute, villous, ca. 1 mm long; petals yellow, glabrous, oblong-ovate or oblong, obtuse, concave, rapidly tapering to short claw (0.5–1 mm long), 5–6 mm long, 2.5–3 mm wide; filaments free, eglandulose, subequal, gradually tapering from the dilated base, barbate below middle, half as long as petals; style glabrous; ovary sessile, glabrous, slightly tuberculate, with appendages; capsules dehiscent, sessile, glabrous, dotted-glandular and with short appendages, 3–4 mm wide. May–June.

Sandy-gravelly soils in foothill deserts. — Caucasus: S. Transc. (valley at middle of Araks River). Gen. distr.: Iran. (Marand). Described from Transcaucasia without exact locality.

9. *H. eugenii korovinii* Pavl. in Byull. S. A. G. U. 21 (1935) 195, cum tabula. — Ic.: Pavl. l. c. —

Perennial; glaucous, completely glabrous semishrub, dotted with glands; stems herbaceous, many, whitish below, yellow above, bearing reduced axillary branches, usually branching only in inflorescence, leafless in the upper part, 20–25 cm high; leaves slightly fleshy, broadly oblong or obovate, rather rapidly tapering to the short petiole, obtuse, obscurely dentate. Inflorescence paniculate-corymbiform, very loose; flowers long-pedicel, mostly ebracteate; sepals deciduous, ovate, acute, slightly ciliate, ca. 1.5 mm long; petals yellow, glabrous, broadly oblong-ovate, obtuse, abruptly tapering to very short claw, 6 mm long, 4.5 mm wide; filaments free, eglandulose, barbate at middle, tapering gradually; style short, glabrous; ovary sessile, tuberculate, pubescent, without appendages; capsules dehiscent, tuberculate, pubescent, without appendages, 4–5 mm wide. May.

Variegated rock outcrops. — Centr. Asia: T. Sh. (Kara-Tau). Endemic. Described from the natural boundary Kzyl-Noiza. Cotype in Leningrad.

10. *H. multicaule* Vved. sp. nova in Addenda XIII, 731.

Perennial; glaucescent, more or less sparsely pubescent semishrub; stems many, with gray or yellowish-gray bark at base, branching, densely leafy, eglandulose, 20–30 cm high; leaves obtuse, sessile, gradually tapering at base, slightly crenate with marginal glands, dotted with glands on surface, more or less flat, lower leaves obovate or oblanceolate, the median and upper oblanceolate or sublinear, the uppermost reduced, linear. Inflorescence loose, with short-pedicel flowers; bracts linear; sepals persistent, triangular-ovate or ovate, acute or obtuse, pubescent, ca. 1 mm long; petals apparently pale yellow, dorsally more or less pubescent, oblong or oblong-elliptic, abruptly tapering to short (ca. 1 mm) claw, 5–6.5 mm long, 2–2.5 mm wide; filaments free, eglandulose, gradually tapering towards apex, barbate below middle, three-fourths as long as petals; ovary short-stalked, pubescent, tuberculate, with indistinct appendages; style pubescent; capsules dehiscent, tuberculate, pubescent, with tuberculate appendages, 3–3.5 mm wide. June–July.

Gypsiferous, rubbly slopes, rarely sands. — Centr. Asia: Ar.-Casp. (southeastern part), Balkh., T. Sh. (Chu-Ili Mountains). Endemic. Described from Chu-Ili Mountains (Chokpar). Type in Tashkent.

11. *H. ramosissimum* Vved. comb. nova. — *H. obtusifolium* var. β . et γ . Bge. in Arb. naturforsch. Ver. Riga, I (1848) 205. — *H. obtusifolium* var. *ramosissimum* Pauls. in Bot. Tidskrift. 27, 2 (1906) 135. — Exs.: Herb. Fl. As. Med. No. 278 (sub *H. obtusifolio* var. *ramosissimum*). —

Perennial; glaucescent or glaucous, more or less finely pubescent semishrub, punctately glandular; stems many, with gray or grayish-yellow bark at base, profusely branching, 20–40 cm high; leaves usually flat, sessile, gradually tapering at base, obtuse, crenate with protruding marginal glands, lower leaves oblong-spatulate or oblong, median leaves linear-oblancheolate or oblancheolate, upper leaves sublinear. Inflorescence very loose, with pediceled flowers; bracts sublinear; sepals persistent, ovate, obtuse, pubescent, ca. 1 mm long; petals pale yellow, glabrous, oblong-elliptic, obtuse, more or less abruptly tapering to short (0.75–1 mm) claw, 4–6 mm long, 2.5–3 mm wide; filaments free, eglandulose, gradually tapering upwards, subequal, barbate inside below middle, three-fourths as long as petals; ovary short-stalked, pubescent, smooth or rarely tuberculate, with appendages; style pubescent or glabrous; capsules dehiscent, on very short stipes, nearly smooth or sparsely tuberculate, pubescent, with appendages, 3.5–4 mm wide. May–June.

Sandy and sandy-gravelly deserts. — Centr. Asia: Kyz. K., Kara K., Amu D. Endemic. Described from Kyzyl-Kum between Kuvan and Dzhandar. Type in Leningrad.

12. *H. obtusifolium* Ldb. Fl. Ross. I (1842) 490; Spach in Jaub. et Sp. III, pl. or. III (1847–1850) 81; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 184; Bge. in Arb. naturforsch. Ver. Riga; I (1848) 205 (quoad var. α .); Boiss. Fl. or. I, 934; E. Korov., Pochv. i bot.-geogr. issl. bass. rr. Syr- i Amu-dar'i, II (1916) 83, p.p. — *H. obtusifolium* var. *eriocarpum* Freyn et Sint. in Bull. Herb. Boiss. 2 sér. IV (1904) 37. — *Ruta obtusifolia* Ldb. in Eichw. Casp. cauc. (1831–1833) 37, tab. 32. — Ic.: Eichw. l. c.

215 Perennial; green or glaucous semishrub, glabrous or finely pubescent along stem; stems many, with bark grayish or yellowish at base, usually branching only below and in inflorescence, 15–40 cm high; leaves obtuse, sessile, gradually tapering at base, usually canaliculate-folded, crenate with protruding marginal glands, lower leaves oblong-oblancheolate or oblancheolate, median and upper leaves oblancheolate or linear. Inflorescence loose, with subsessile axillary flowers; bracts linear; sepals persistent, ovate, obtuse, glabrous, ca. 1 mm long; petals yellow, glabrous, oblong-elliptic, abruptly tapering to short (0.5–1 mm) claw, 4–6 mm long, 2.5–3 mm wide; filaments free, eglandulose, gradually tapering at apex, barbate inside below middle, three-fourths as long as petals; ovary short-stalked, glabrous to densely pubescent, densely tuberculate, with appendages; style glabrous; capsules dehiscent, on very short stipe, densely tuberculate, glabrous or pubescent, with appendages, 3.5–4 mm wide. May–June.

Chalks, variegated rock outcrops, rubbly slopes, rarely sands. — Centr. Asia: Ar.-Casp., Mtn. Turkm. Endemic. Described from the vicinity of Krasnovodsk. Type in Leningrad.

Note. Lipskii's record from Samarkand (Zap. Kievsk. obshch. Estest. XI, 2 (1891) 8 et herb.!) is undoubtedly due to a mix-up in labels.

13. *H. monodelphum* Afan. in Bot. Mat. Gerb. Bot. Inst. AN SSSR. XI (1949) 125.

Perennial; glaucescent semishrub; stems 30–50 cm high, branching, glabrous, with bark dark gray below, brownish and distinctly glandular-dotted at the middle part, in the upper part the youngest shoots green, obscurely glandular-dotted; leaves linear or linear-oblong, somewhat spatulate, gradually tapering at base, lower leaves up to 3.5 mm wide, the upper up to 1 mm wide, entire, thick, glabrous, sparingly punctate-glandular. Inflorescence elongate, racemiform, loose, with spreading flowers on 0.5–1.5 cm long pedicels; bracts small, linear-lanceolate, green; sepals persistent, ovate or broadly lanceolate, narrowly white-scarious at margin, ciliate, glandular-dotted; petals oblong-oval, keeled, glabrous, sparingly and obscurely glandular-dotted, ca. 8 mm long, 4 mm wide; filaments dilated and connate for three-fourths of their length, unequal in the upper free part, abruptly tapering, glabrous and obscurely dotted outside, white-hairy inside at the upper part, shorter than petals; ovary glabrous, without appendages; style short, glabrous, with capitate stigma; capsules dehiscent, subsessile. July–September.

Rubbly slopes in the lower mountain zone (deserts and mountainous semideserts). — Centr. Asia: Pam.-Al. (Turkestan Range). Endemic. Described from Keravshin River valley. Type in Leningrad.

216 14. *H. dshungaricum* Rubtz. in Bot. Mat. Gerb. Bot. Inst. AN SSSR. VIII (1940) 63.

Perennial; green, semishrub, usually completely glabrous, multicaulescent, punctately glandular; stems branching below and in inflorescence, sometimes short-hairy, thin, 15–40 cm high; leaves entire, slightly fleshy, linear, canaliculate, obtuse, lower leaves narrowly linear or obtriangular-linear. Inflorescence paniculate-corymbiform, loose, few-flowered; bracts linear; sepals persistent, ovate to suborbicular, obtuse, glabrous, ca. 1 mm long; petals yellow, glabrous, ovate or broadly ovate, obtuse, with very short (0.5–1 mm) claw, 8–10 mm long, 5–6 mm wide; filaments free, eglandulose, villous inside at the lower half, gradually then more or less abruptly tapering, half to three-fourths as long as petals; style hairy; ovary subsessile, tuberculate, more or less pubescent, with appendages; capsules dehiscent, on short stipe, tuberculate, more or less hairy, with appendages, ca. 4 mm wide. August.

Rocks in the central mountain belt. — Centr. Asia: Dzu.-Tarb. (Dzungarian Ala-Tau). Endemic. Described from the gorge of Borokhudzir River. Type in Leningrad.

15. *H. foliosum* Vved. in Bot. Mat. Gerb. AN UzbSSR, X (1948) 4.

Perennial; glaucous, completely glabrous plants, woody at base, punctate-glandular; stems many, floriferous and sterile, more or less ascending at

base, virgate, but densely leafy, branching above, (10)25–50 cm high; leaves slightly fleshy, entire, linear, canaliculate, obtuse, gradually tapering at base, sessile. Inflorescence corymbiform, rather dense at top of stems and branches; bracts linear, few; sepals persistent, nearly free, ovate, obtuse, glabrous, ca. 1 mm long; petals yellow, glabrous, oblong-elliptic or oblong, abruptly tapering to short (ca. $\frac{3}{4}$ mm) claw, 4–4.5 mm long, 2 mm wide; filaments free, subequal, with glands, oblong-triangular, tapering to short tip, barbate inside, three-fourths as long as petals; style short, thick, glabrous; ovary sessile, glabrous, rather smooth, with tuberculate appendages; capsules dehiscent, glabrous, densely dotted-glandular, with tuberculate appendages, rarely without, 2.5–3 mm wide. June–August.

Slopes with fine soil at an altitude of 600–1,400 m. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from Koiki-Tau (Termez-Shaartuz). Type in Tashkent.

16. *H. tenuisectum* Lincz. et Vved. sp. nova in Addenda XIII, 732. —

- Perennial; green or glaucescent, completely glabrous semishrub, punctate-glandular, glands sometimes protruding on stem; stems many, hardly ascending at base, virgate, usually branching above, leafless under inflorescence, 40–85 cm high; leaves slightly fleshy, glaucous when young, 3(6)-sect (from the middle) into linear, canaliculate, obtuse segments, tapering at base, lowermost leaves spatulate, entire, uppermost reduced, entire, linear. Inflorescence corymbiform, terminal on stem and branches, rather dense; bracts reduced like upper leaves; sepals ovate, obtuse, glabrous, tuberculate, ca. 0.75 mm long; petals yellow, glabrous, elliptic or oblong-ovate, obtuse, usually abruptly auriculate-tapering to a short (0.5–0.7 mm) claw, 5–6 mm long, 2–3 mm wide; filaments free, subequal, glandular, oblong-triangular, rather abruptly tapering to a short tip, barbate inside at the middle, half as long as petals; style short, glabrous; ovary sessile, glabrous, nearly smooth, with tuberculate appendages; capsules dehiscent, subsessile, glabrous, densely dotted-glandular, with or without tuberculate appendages, 3–3.5 mm wide. July–August. (Plate XII, Figure 3).

Variegated rock outcrops. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from the vicinity of Mikoyanabad. Type in Leningrad.

17. *H. leptomerum* Lincz. et Vved. sp. nova in Addenda XIII, 731.

Perennial; green or glaucescent, glabrous semishrub punctate-glandular; stems many, ascending at base, virgate, branching and leafless above, 25–50 cm high; leaves slightly fleshy, glaucous when young, 3-sect (from base) into linear, canaliculate, obtuse segments, gradually tapering at base, lowermost leaves spatulate, entire, uppermost leaves reduced, sometimes entire, linear. Inflorescence at top of stems and branches corymbiform, rather dense; bracts few, linear; sepals persistent, ovate, obtuse, glabrous, ca. 0.75 mm long; petals yellow, glabrous, elliptic, obtuse, rather gradually tapering to short (0.75–1 mm) claw, 3.5–5 mm long, 1.5–2 mm wide; filaments free, glandular, barbate inside below middle, oblong-triangular, more or less gradually tapering to a short tip, half as long as petals; ovary sessile, pubescent, very finely tuberculate, with appendages; capsules dehiscent, pubescent, subsessile, densely dotted-glandular, with short corniform appendages, 3–3.5 mm wide. July–August. (Plate XII, Figure 3.)

Variegated rock outcrops at altitude of 500–1,500 m. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from Babatag Mountains. Type in Leningrad.

18. *H. tenue* Boiss. Fl. or. I (1867) 932; Grossg., Fl. Kavk. III (1932) 19. — *H. villosum* var. *glabrescens* Boiss. et Buhse in Nouv. Mém. Soc. Nat. Mosc. XII (1860) 51 (quoad pl. transcausicam).

218 Perennial; glaucescent, herbaceous plants, punctate-glandular; stems few, virgate, ascending at base, colored below, simple, glabrous, leafless above and more or less crisp-hairy, 25–40 cm high; leaves entire, glabrous, oblanceolate or linear-oblanceolate, and gradually long tapering at base, shortly petiolate, acute, the upper reduced, siblinear. Inflorescence corymbiform, dense, with crisp-hairy branches and pedicels; bracts nearly obsolete; sepals ovate, obtuse, villous, ca. 1 mm long; petals yellow, glabrous, oblong, obtuse, more or less gradually tapering to short claw, 6 mm long, 2.5 mm wide; filaments free, subequal, more or less abruptly tapering from the dilated base, glandular, barbate at middle, half as long as petals; style glabrous; ovary sessile, glabrous, tuberculate, with appendages. June.

Slopes of fine earth in the lower mountain belt. — Caucasus: S. Transc. Endemic. Described from the Alindzhachai River valley. Cotype in Leningrad.

19. *H. ciscaucasicum* Grossh. et Vved. comb. nova. — *H. villosum* var. *ciscaucasicum* Rupr. in Mém. Acad. Petersb. 7 ser. XV, 2 (1869) 278; Grossg., Fl. Kavk. III (1932) 19. — Exs.: G.R.F. No. 963 (sub *H. villosa* var. *ciscaucasica*).

Perennial; green semishrub; stems many, herbaceous, inconspicuously glandular, long-crisp-hairy, ascending at base, branching or often simple, above, with reduced axillary branches, densely leafy up to apex, 10–25 cm high; leaves entire, oblong-oblanceolate, rarely oblong-lanceolate or oblanceolate, more or less abruptly tapering to short petiole, obtuse, dotted-glandular, short-appressed-hairy, rarely subglabrous. Inflorescence corymbiform, dense; bracts foliaceous, reduced; sepals apparently persistent, ovate, obtuse, villous, ca. 1 mm long; petals yellow, glabrous, oblong-ovate or oblong, obtuse, more or less abruptly tapering to long (1–2 mm) claw, 6–8 mm long, 2.5–3 mm wide; filaments free, subequal, glandular, gradually tapering from a dilated base, hairy beneath, barbate inside above middle, half to one and a quarter times as long as petals; style glabrous; ovary sessile, more or less hairy, tuberculate, with large, sometimes 3-lobed appendages; capsules dehiscent, subsessile, densely and finely tuberculate, more or less hairy, with large appendages hamately curved at apex, 3–4 mm wide. June–July.

Stony slopes, limestone outcrops in central mountain belt. — Caucasus: Cisc. Endemic. Described from the vicinity of Dzheguta Station and Kislovodsk. Type in Leningrad.

20. *H. villosum* (M.B.) G. Don, Gen. Syst. I (1831) 780; Ldb. Fl. Ross. I (1842) 490; Trautv. Pl. imag. et descr. (1844) 40, tab. 28
219 (exclus. spec. cauc.); Spach in Jaub. et Sp. III. pl. or. III (1847–1850) 81, tab. 264; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 183; Boiss. Fl. or. I, 931; Aschers. et Graebn. Syn. VII, 251; Grossg., Fl. Kavk. III, 19. — *Ruta villosa* M.B. Tabl. (1798) 114. — *R. parviflora* Desf. Choix pl. coroll. (1808) 71, tab. 54. — Ic.: Jaub. et Sp. l. c.

Perennial; glaucescent, herbaceous plants, more or less densely crisp-hairy, punctate-glandular; stems few, ascending at base, simple or branching, usually with reduced axillary branches, rather densely leafy, 15–40 cm high; leaves entire, oblong-ob lanceolate or oblanceolate, rarely oblong, obtuse or rarely acute, gradually tapering at base to short petiole, upper leaves linear-lanceolate. Inflorescence at summits of stems and branches corymbiform, rather dense; bracts few, linear or linear-lanceolate; sepals deciduous, ovate, obtuse, villous, ca. 1 mm long; petals yellow, glabrous, oblong, obtuse, more or less gradually tapering to short (1–1.5 mm) claw, 6.5–7 mm long, 2.5–2.75 mm wide; filaments free, subequal, glandular, gradually tapering from a dilated base, pubescent below, barbate inside below middle, half to three-fourths as long as petals; style glabrous; ovary sessile, pubescent, tuberculate, with appendages; capsules dehiscent, subsessile, densely and finely tuberculate, pubescent, with appendages, 3–4 mm wide. June–August. (Plate XII, Figure 2).

Slopes of fine earth or rubble in semideserts up to the central mountain belt. — Caucasus: Dag., E. and S. Transc. **Gen. distr.:** As.-Min., Iran. Described from Beshbarmak Mountain. Type in Leningrad.

21. *H. schelkovnikovii* Grossh. in Beih. Bot. Centralbl. XLIV, 2 (1927) 225; Grossg., Fl. Kavk. III (1932) 20.

Perennial; glaucescent, herbaceous, more or less densely crisp-hairy plants; stems few, inconspicuously glandular, usually ascending at base, branching above, rarely from the middle, usually with reduced axillary branches, rather densely leafy, 15–30 cm high; leaves 3-sect (the lowermost entire), short-petioled or subsessile, with oblanceolate or linear-ob lanceolate, acute, dotted-glandular segments, long-tapering at base. Inflorescence corymbiform at summits of stem and branches, rather dense; bracts few, linear; sepals persistent, ovate or oblong, obtuse, more or less villous, 1–1.5 mm long; petals yellow, glabrous, oblong or ovate, obtuse, with short claw, 5.5–6 mm long, 3–3.5 mm wide; filaments free, subequal, glandular, abruptly tapering from a dilated base, barbate inside above dilation, three-fourths as long as petals; style glabrous; ovary sessile, more or less densely pubescent at apex, tuberculate, without appendages; capsules dehiscent, sessile, densely tuberculate, more or less pubescent, without appendages, 3–3.5 mm wide. May–June.

Dry slopes in the lower mountain belt; as a weed. — Caucasus: S. Transc. Endemic. Described from near Dzhulfa Station.

Note. Hardly distinguished by the pubescent ovary from *H. halimifolia* Spach, and therefore should be further studied.

22. *H. dubium* Eug. Kor. in Tr. Turk. Nauchn. Ob-v. I (1923) 37. — *H. Alberti Regelii* f. *subternata* Eug. Kor. in Pochv. i bot.-geogr. issl. bass. rr. Amu- i Syr-dar'i, II (1916) 59.

Perennial; glaucous or glaucescent, glabrous or rarely spreading-hairy herbaceous plants, finely punctate-glandular; stems few, ascending, branching, often colored at base, 15–60 cm high; lowermost and uppermost leaves and leaves on branches entire, oblanceolate, oblong-ob lanceolate or linear-ob lanceolate, obtuse, gradually tapering at base to rather long petiole, median and upper leaves 3-sect or rarely 5-sect into segments resembling

leaves. Inflorescence corymbiform, loose, with sessile or subsessile axillary flowers; bracts nearly obsolete; sepals persistent, ovate, obtuse, more or less ciliate, ca. 0.75 mm long; petals yellow, oblong or oblong-lanceolate, 5–5.8(8) mm long, 2–2.5 mm wide, gradually tapering to 1–2 mm long claw; filaments almost free but connate at base, glandular, more or less abruptly dilated below, barbate inside, three-fourths as long as petals, inner filaments narrower; style glabrous, 2–2.5 mm long; ovary sessile, more or less pubescent, finely tuberculate; capsules dehiscent, without appendages, more or less pubescent, finely tuberculate, subsessile, ca. 3–4 mm wide. May–June.

Loess slopes and variegated rock outcrops. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from several localities in southern Pamir-Alai. Type in Tashkent.

Note. The plants in the eastern part of the distribution area differ slightly by way of their narrower leaves and greener color. They should be further studied.

23. *H. vvedenskyi* Nevski in Tr. Bot. Inst. AN SSSR, 1 ser. IV (1937) 268, f. 5. — Ic.: Nevski, l. c.

Perennial; glaucescent, glabrous, herbaceous plants, punctate-glandular; stems few, ascending, colored beneath, branching in upper part, 40–50 cm high; leaves 3-sect, short-petioled or sessile, segments linear-ob lanceolate or sublinear, obtuse, gradually tapering at base, sometimes with lateral lobe, 221 leaves on branches and some of the lowermost sometimes entire. Inflorescence corymbiform, loose; bracts nearly obsolete; sepals persistent, ovate, obtuse, glabrous, ca. 1 mm long; petals yellow, oblong, abruptly tapering to long (1.5–2 mm) claw, 7–8.5 mm long, 3–3.5 mm wide; filaments almost free but connate at base, glandular, dilated below, gradually then abruptly tapering, barbate inside, nearly half as long as petals; style glabrous or rarely pubescent, 3–3.5 mm long; ovary subsessile, pubescent, finely tuberculate, with tuberculate appendages; capsules (immature) finely tuberculate, pubescent, with tuberculate appendages. June.

Slopes of fine earth in foothills. — Centr. Asia: Pam.-Al. (Kugitang). Endemic. Described from Kugitang village. Type in Leningrad.

Note. This problematic species is known only from its traditional habitat. Its resemblance to *H. dubium* Eug. Kor. is extraordinary.

24. *H. alberti* Regelii Eug. Kor. in Pochv. i bot.-geogr. issl. bass. rr. Amu-i Syr-dar'i, II (1916) 59, tab. 13 (excl. f. subternata). — Ic.: Eug. Kor. l. c.

Perennial; green, glabrous or rarely more or less crisp-hairy, herbaceous plants, covered with slightly protruding glands; stems 1–3(5), erect or ascending at base, simple or somewhat branching, loosely leafy, 15–50 cm high; leaves long-petioled, 3-sect, with lanceolate or oblong, acute or obtuse segments, tapering at base to long petiolule, the lateral segments usually narrower, sometimes the lowermost leaves (and uppermost) reduced, entire, oblong or oblong-obtuse, rarely all leaves entire, oblong-lanceolate or oblong. Inflorescence glabrate, with sessile or subsessile flowers; bracts nearly obsolete; sepals persistent, ovate, obtuse, glabrous or ciliate, ca. 0.75 mm long; petals yellow, sometimes dorsally greenish, glabrous, lanceolate, 6–8 mm long, ca. 2.5 mm wide, with 1–2 mm long claw; filaments

connate at base, subequal, glandular, abruptly dilated below, barbate inside, half as long as petals; style glabrous; ovary sessile, glabrous, tuberculate, without appendages; capsules dehiscent, subsessile, glabrous, sparingly tuberculate, 3–4 mm wide. May–June.

Variegated rock outcrops and loess slopes. — Centr. Asia: Pam.-Al. (southern and southwestern parts). Endemic. Described from several localities in S. Pamir-Alai. Type in Tashkent.

Note. A polymorphic species variable in pubescence and dissection of leaves; it should be further studied.

- 222 25. *H. bungei* Trautv. in Tr. B. S. VIII (1883) 183; E. Korov., Pochv. i bot.-geogr. issl. bass. rr. Syr- i Amu-dar'ii, II (1916) 84. — *H. elatum* Fisch. et Mey. in Bull. Soc. Nat. Mosc. XII (1839) 149 (nomen nudum). — *H. versicolor* Bge. in Arb. naturforsch. Ver. Riga, I (1848) 207, non Fisch. et Mey.; Boiss. Fl. or. I (1867) 935. — *Ruta Bungei* B. Fedtsch (1915) 555.

Perennial; green, completely glabrous, herbaceous plants, covered with protruding glands; stems yellowish, shiny, erect or ascending, branching, leafless in upper part, 30–60 cm high; leaves entire, gradually tapering to short petiole, sometimes slightly curled, lower leaves broadly oblong or suborbicular, obtuse, median and upper leaves oblong or lanceolate. Inflorescence loose, nearly ebracteate; sepals persistent, ovate, obtuse, ca. 0.75 mm long; petals yellow, with black protruding glands, glabrous, oblong, obtuse, 6 mm long, 2 mm wide, abruptly tapering to ca. 1 mm long claw; filaments connate at base, equal, three-fourths as long as petals, abruptly dilated below, glandular, barbate inside; ovary sessile, glabrous, tuberculate, almost without appendages; style glabrous; capsules dehiscent, densely tuberculate, glabrous, with very short appendages, 4–5 mm wide. May–June.

Sandy deserts, rarely on variegated rock outcrops. — Centr. Asia: Ar.-Casp., Syr D. (Fergana Valley), T. Sh. (northern end of Kara-Tau), Kyz. K., Kara K., Pam.-Al. (southern part). Gen. distr.: Iran. Described from Kyzyl-Kum. Cotype in Leningrad.

26. *H. popovii* Eug. Kor. in Bot. Mat. Gerb. Bot. Sada, V (1924) 178.

Perennial; glaucescent or green, herbaceous plants, completely glabrous, punctate-glandular; stems rather robust, erect, branching above or only in inflorescence, 40–80 cm high; leaves entire, broadly oblong or oblong, rarely oblong-lanceolate or suborbicular, acute or rarely obtuse, gradually tapering to petiole, entire or more or less serrate, leaves on branches reduced, lanceolate. Inflorescence corymbiform, dense, with pediceled flowers; bracts few, lanceolate or linear; sepals persistent, glabrous, oblong-ovate, acute, ca. 1 mm long; petals dark yellow, glandular, glabrous, lanceolate, gradually tapering to 1.5 mm long claw, 5–6 mm long, 2 mm wide; filaments connate at base, abruptly dilated below, glandular, barbate inside, nearly half as long as petals, inner filaments narrower; style glabrous; ovary glabrous, sessile, finely tuberculate, without appendages; capsules dehiscent, sessile, glabrous, finely tuberculate, without appendages, 3–3.5 mm wide. May–July. (Plate XII, Figure 1.)

- 223 Slopes of fine earth in the lower mountain belt; a weed. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from Babatag Mountains (Chinar-i-Sokhta). Type in Tashkent.

27. *H. robustum* Bge. in Arb. naturforsch. Ver. Riga, I (1848) 208; Boiss. Fl. or. I, 935; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Amu- i Syr-dar'i, II (1916) 83. — *Ruta robusta* B. Fedtsch. in Rast. Turk. (1915) 555. — Ic.: Bge. Ic. pl. nov. (1851) tab. 11, f. 2. — Exs.: G. R. F. No. 1858.

Perennial; gray-green, herbaceous plants, pubescent, tuberculate-glandular; stems robust, branching above or in inflorescence, 30–80 cm high; leaves entire, thick, densely pubescent beneath, usually broadly elliptic, oblong or obovate, obtuse or often shortly attenuate, gradually tapering to long petiole longer than half of the blade. Inflorescence corymbiform, dense, with subsessile flowers; bracts nearly obsolete; sepals persistent, oblong-ovate, obtuse, pubescent, ca. 1 mm long; petals pale yellow, dorsally greenish, sometimes slightly pubescent, oblong-lanceolate, more or less abruptly tapering to 1 mm long, nearly square claw, 6–8 mm long, 2–3 mm wide; filaments free, barbate inside at middle, nearly three-fourths as long as petals, unequal, the inner narrowly triangular or lanceolate, the outer broader, triangular-lanceolate, excurrent at the short tip; style glabrous; ovary sessile, tuberculate, more or less pubescent, with short appendages; capsules dehiscent, sessile, tuberculate, more or less pubescent, with tuberculate appendages, ca. 5 mm wide. May–June.

Variegated rock outcrops, stabilized sands, stony deserts. — Centr. Asia: Kyz. K., Kara K., Pam.-Al. Gen. distr.: Iran. Described from Kyzyl. Kum, between Kara-agach and Agitma. Cotype in Leningrad.

28. *H. ferganicum* Vved. in Bot. Mat. Gerb. AN UzbSSR, X (1948) 3. —

- Perennial; glaucous, herbaceous plants, punctate-glandular; stems few, erect or ascending, simple or rarely branching, crisp-hairy, 10–40 cm high; leaves gathered at the lower part of stem or evenly disposed along stem, entire, subsessile, more or less crisp-hairy or glabrous, lower leaves obovate or oblanceolate, obtuse, upper leaves linear-oblanceolate or linear-lanceolate, obtuse or acute. Inflorescence corymbiform, dense, subvillous, with subsessile flowers; bracts linear, villous, often obsolete; sepals persistent, ovate-triangular, obtuse, villous, 1–1.5 mm long; petals pale yellow, dorsally pubescent, greenish or dull purple, oblong, obtuse, abruptly tapering to ca. 1.5 mm long claw, 6–7 mm long, 2.5–3 mm wide; filaments connate at base, glandular, glabrous or more or less pubescent at the middle, more or less abruptly tapering from the lower third, slightly shorter or nearly half as long as petals; style more or less pubescent; ovary very short-stalked, pubescent or rarely subglabrous, with short appendages; capsules dehiscent, subsessile, more or less pubescent, tuberculate, with tuberculate appendages, ca. 4 mm wide. April–July.
- 224

Clayey and stony slopes in foothills; as a weed. — Centr. Asia: Syr D. (Fergana Valley). Endemic. Described from the vicinity of Kim. Type in Tashkent.

Note. A polymorphic species that should be further investigated.

29. *H. versicolor* Fisch. et Mey. in Bull. Phys. Math. Acad. Pétersb. III (1845) 307. — *H. lasianthum* Bge. in Arb. naturforsch. Ver. Riga, I (1848) 206; Boiss Fl. or. I (1867) 936; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Amu- i Syr-dar'i, II (1916) 84. — *H. hispidulum* Bge. in Boiss. Fl. or. I (1867) 933. — *Ruta rotundifolia* Aitch. et Hemsl. in Trans. Linn. Soc. Bot. 2 sér. III (1888) 45, tab. 5, f. 11–16. — *H. brevipilum* Freyn et Sint. in Bull. Herb. Boiss. 2 sér. IV (1904) 39. — *R. versicolor* B. Fedtsch. Rast. Turk. (1915) 555. — Ic.: Bge. Ic. pl. nov. (1851) tab. 11, f. 1. — Exs.: Herb. Fl. As. Med. No. 280.

Perennial; glaucous or glaucescent, herbaceous plants, sparingly short-pubescent, very rarely glabrous, punctate-glandular, glands protruding in inflorescence; stems thin, ascending, branching, often simple, with reduced axillary branches, 10–25 cm high; leaves entire, subsessile or the lower short-petioled, gradually tapering at base, often undulate at margin, uppermost leaves obovate or suborbicular, obtuse, median and upper leaves oblong, oblong-lanceolate or rarely lanceolate, obtuse or usually acute. Inflorescence loose, with subsessile relatively large axillary flowers; bracts linear; sepals persistent, ovate, obtuse, pubescent, ca. 0.75 mm long; petals pale yellow, dorsally greenish or dull purple, pubescent, very rarely glabrous, oblong, obtuse, abruptly tapering to ca. 1 mm long claw, 5–6(9) mm long, (2)2.5(3) mm wide; filaments connate at base, subequal, glandular, abruptly dilating below, barbate inside, often short-hairy above, three-fourths as long as petals; ovary subsessile, glabrous or pubescent, tuberculate, with or without short appendages; style pubescent or glabrous; capsules dehiscent, short-stipitate, glabrous or pubescent, tuberculate, sometimes with rodlike or clavate tubercles at apex, with or without tuberculate appendages, 3–3.5 mm wide. May–June.

225 Clayey, rarely stony or sandy places in deserts and foothills; as a weed. — Centr. Asia: Ar.-Casp., Balkh., Syr D., Amu D., Kyz. K., Kara K., T. Sh., Pam.-Al., Mtn. Turkm. Gen. distr.: Afghanistan, Iran. Described from Chu-Ili Mountains (Dzhambul). Type in Leningrad.

Note. The specimens from the north (Aral and Tien Shan in Central Asia) are easily distinguished from those occurring in the Kopet Dagh area, Afghanistan and Iran by the absence of appendages on the ovary, the presence of many rodlike tubercles at the apex of the capsule, and by the wider leaves; in a large part of the area of distribution (W. Tien Shan, W. Pamir-Alai and adjacent deserts) there are, however, plants in which these characters are obsolete or degenerate. There is no geographical correlation with the absence of each of these characters; yet it is possible to assume that with the accumulation of more material we may be able to split this intermediate *H. versicolor* into a series of local species, maintaining the northern *H. versicolor* s. s. (= *H. lasianthum*) and the southern *H. hispidulum* (= *R. rotundifolia* = *C. brevipilum*) as separate species. Especially interesting is the completely glabrous (including petals) form (var. *leianthum* Vved. in sched. ad Herb. Fl. As. Med. (1927) No. 280) described from the Naryn River valley and recently found in Urgat district.

Section 4. ACHAENOCOCCUM Vved. — Sect. II, Boiss. Fl. or. I (1867) 935. — Ovary 5-locular, with 2 ovules in each cell; capsule indehiscent, with falling or persistent cells.

30. *H. latifolium* Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 398; Ldb. Fl. Ross. I (1842) 491; Spach in Jaub. et Sp. III. pl. or. III (1847–1850) 83; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 188; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Syr- i Amu-dar'i, II (1916) 83. — *Ruta latifolia* B. Fedtsch., Rast. Turk. (1915) 555. — Exs.: Herb. Fl. As. Med. No. 435.

Perennial; green, herbaceous plants, completely glabrous, punctate-glandular; stems robust, corymbiformly branching, 25–60 cm high; leaves subsessile or short-petioled, entire, oblong-lanceolate, oblong or broadly oblong, sometimes suborbicular, obtuse or acute. Inflorescence paniculate-corymbiform, many-flowered; flowers pedicellate; sepals persistent, suborbicular, obtuse, glabrous, ca. 1.5 mm long; petals glabrous, glandular, dark yellow, oblong or oblong-ovate, obtuse, more or less abruptly tapering to ca. 1 mm long claw, 9–12 mm long, 5–6 mm wide; filaments free, glandular, abruptly dilating at the lower half, barbate inside, half as long as petals; ovary sessile, glabrous, tuberculate, without appendages; style glabrous; capsules indehiscent, apparently with persistent cells, glabrous, densely covered with rod-shaped tubercles, (4)5 mm wide. May–June.

Stony and fine earth slopes of the foothills up to the central mountain belt. — Centr. Asia: Dzu.-Tarb., T. Sh., Pam.-Al. (northern part). Endemic. Described from Tarbagatai. Cotype in Leningrad.

31. *H. acutifolium* (DC.) G. Don, Gen. Syst. I (1831) 780; DC. in Deless. Ic. sel. III (1837) 26, tab. 44; Spach in Jaub. et Sp. III. pl. or. III (1847–1850) 83; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 187; Boiss. Fl. or. I (1867) 942; E. Korov. in Pochv. i bot.-geogr. issl. bass. rr. Amu- i Syr-dar'i, II (1916) 83. — *Ruta acutifolia* DC. Prodr. I (1824) 711. — Ic.: Deless. l. c.

Perennial; green or glaucescent, herbaceous plants, glandular, glands slightly protruding in inflorescence; stems erect, corymbiformly branching, glabrous, 20–50 cm high; leaves glabrous, broadly oblong to narrowly lanceolate, acute or obtuse, gradually tapering to short petiole, entire. Inflorescence paniculate-corymbiform, with glabrous branches; bracts linear, usually glabrous; sepals persistent, free for $(\frac{1}{2})\frac{3}{4}$ of their length, ovate-triangular, obtuse, usually glabrous, rarely (together with pedicels) slightly pubescent, ca. 1 mm long; petals yellow, (4)5–6 mm long, oblong or oblong-lanceolate, curved below, usually abruptly tapering to 1–2 mm long claw; filaments free, subequal, barbate inside, glandular, abruptly dilated at the lower half, three-fourths as long as petals; style glabrous; ovary sessile, glabrous, tuberculate, without appendages; capsules indehiscent, with falling cells, very short-stipitate, densely tuberculate, 3(4) mm wide. May–June.

Stony and fine earth slopes in the lower and central mountain belts. — Centr. Asia: Mtn. Turkm. Gen. distr.: Iran. Described from Iran (between Kermanshah and Hamadan). Type in Geneva.

32. *H. perforatum* (M.B.) Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 397. — *Ruta divaricata* Siev. in Pall. Neue Nord. Beitr. III (1796) 333 (nomen nudum). — *R. perforata* M. B. Besch. Länd. casp.

(1800) 172. — H. Sieversii Fisch. in Schrenk, Enum. pl. nov. 1 (1841) 89; Ldb. Fl. Ross. I (1842) 491; Trautv. Pl. imag. et descr. (1844) 39, tab. 27; Spach in Jaub. et Sp. III, pl. or. III (1847–1850) 83; Spach in Ann. Sc. Nat. Bot. 3 sér. XI (1849) 187. — H. suaveolens Ldb. Fl. Ross. I (1842) 491 (quoad var. α). — R. Sieversii B. Fedtsch., Rast. Turk. (1915) 555; Kryl., Fl. Zap. Sib. VIII, 1855. — Ic.: Trautv. l. c. — Exs.: Herb. Fl. As. Med. No. 276 (sub H. acutifolio).

Perennial; green or glaucescent, herbaceous plants, punctate-glandular; stems erect, corymbiformly branching, glabrous, 30–70 cm high; leaves 227 glabrous, broadly oblong to lanceolate, acute or obtuse, gradually tapering to short petiole, entire. Inflorescence paniculate-corymbiform, many-flowered, with more or less pubescent branches; bracts linear, more or less pubescent; sepals persistent, free nearly to base, triangular, acute or very acute, more or less pubescent, ca. 1 mm long; petals yellow (8) 3.5–4(5.5) mm long, oblong-lanceolate, curved below; usually gradually tapering to ca. 1 mm long claw; filaments free, subequal, barbate inside, glandular, abruptly dilated below, three-fourths as long as petals; style glabrous; ovary sessile, glabrous, tuberculate, without appendages; capsules indehiscent, with falling cells, very short-stipitate, densely tuberculate, 3(4) mm wide. May–July.

Stony and fine earth slopes of foothills and the lower mountain belt. — Centr. Asia: Balkh., Dzu.-Tarb., T. Sh., Pam.-Al. Gen. distr.: W. Mong., Kuldja. Described from Siever's collections, erroneously denoting Lake Baikal as the original place. The type was probably collected somewhere between Altai and Semipalatinsk, terrain through which Sievers traveled. Type in Leningrad.

Genus 845. **DICTAMNUS** * L.

L. Sp. pl. (1753) 548; Gen. pl. ed. V (1754) 168

Flowers irregular, bisexual; sepals 5, persistent; petals 5, short-clawed, the lower spreading; stamens 10, declinate, free, with subglobular anthers; style 1, declinate, with truncate stigma; ovary 5-locular; capsule stipitate, dehiscing at inner side of cells, with easily separating endocarp; 2–3 seeds in each cell, black, shiny, smooth. Perennial large herbs, with median and upper leaves imparipinnate and lower leaves entire, in upper part (stems, pedicels, bracts, all floral parts) with many black glands.

Note. The plants during flowering time contain such large quantities of essential oils that even in calm sunny weather a lighted match sets them aflame. Contact with the live plant causes burns in the form of blisters within 24 hours. It is not clear what causes the burns or whether this phenomenon is common to all the species of the genus (compare Russk. vest. dermat. VII (1929) 58).

D. albus auct. consists throughout its extensive distribution area, which extends from the Pacific to the Atlantic and from the Central Urals to 228 the Himalayas, of a group of species, some local (compare, for example, Borbas

* This name was used by ancient authors; it derives from the words Dicte — a mountain in Crete, and thamos — shrub.

in Termesz, fiz. 19 (1896) 348–357), which cannot be properly investigated for the lack of good collections. Because most of the herbarium material consists of only the tops of the plants it is impossible to study other characters that are so important for the classification of *Dictamnus*, mainly the pubescence of the lower part of the stems and differences in form and number of leaflets along the whole plant. Good collections from Asia Minor and the Balkans are needed, since without a careful study it is impossible to classify the West Ukrainian, Moldavian and West Transcaucasian *Dictamnus*.

1. Ovary usually glabrous, hornless or with short horn, with only few stalked glands, on (2)3–4(5) mm long glabrous stipe; style glabrous; leaflets (2)3–4(5) pairs, large, usually elliptic or oblong-elliptic, generally not attenuate at apex; stems densely and more or less long-crisp-hairy down to base 5. *D. gymnostylis* Stev.
- + Ovary sparingly or densely hairy, on 1–2 mm long stipe, if glabrous then on stipe up to 3 mm but with many stalked glands at apex and leaflets small, (3–4)5–6(8) pairs; stems glabrous below, if pubescent then finely hairy and leaflets usually long-attenuate at apex 2.
2. Petals abruptly tapering to relatively short claw; leaflets small, usually oblong-lanceolate, short-attenuate at apex; stems sparingly and shortly crisp-hairy at the middle; style glabrous; ovary on 2–3 mm long stipe 4. *D. caucasicus* Fisch.
- + Petals gradually tapering to long claw; leaflets large, usually oblong-elliptic and long-attenuate at apex; ovary on 1–2 mm long stipe . . . 3.
3. Leaf-rachis distinctly winged; stems sparingly long-hairy above, often subglabrous; ovary densely hairy; style hairy 1. *D. dasycarpus* Turcz.
- + Leaf-rachis nearly wingless; stems more or less densely hairy at the middle; ovary sparsely hairy 4.
4. Stems long-hairy in the middle part, usually glabrous below, rarely short-hairy. Capsule with (5)7–12 mm long horns; style usually glabrous 3. *D. angustifolius* G. Don.
- 229 + Stems shortly-crisp-hairy down to base. Capsule with 5–8 mm long horns; style usually hairy 2. *D. tadshikorum* Vved.

1. *D. dasycarpus* Turcz. in Bull. Soc. Nat. Mosc. XV (1842) 637; Borb. in Term. Flz. XIX (1896) 351; Kom. and Alis., Opredel. r. Dal'nevost. kr. II, 696, tabl. 210. — *D. Fraxinella* Lus. c. Ldb. Fl. Ross. I (1842) 495. — *Aquilegia Fouriei* Liv. in Bull. Acad. Int. Geogr. Bot. XI (1902) 300. — *D. albus* ssp. *dasycarpus* Wint. in Bot. Mat. Gerb. Bot. Sada, V (1924) 159. — *D. albus* et *fraxinella* auct. fl. or. extrem. — Ic.: Kom. and Alis. l. c. — Exs.: Karo, Pl. amur. et zeaën. No. 74.

Perennial; stems sparingly long-hairy, often subglabrous, always glabrous below, 35–80 cm high; leaves imparipinnate, with (3)5(6) pairs of leaflets; rachis winged, more or less long-hairy; leaflets usually large, oblong or often oblong-elliptic, usually long-attenuate above, acute, irregularly biserrate, more or less long-hairy beneath mainly along nerves, sometimes subglabrous, terminal leaflet usually more or less rounded at base, with broadly winged petiolule. Inflorescence racemiform, rarely paniculate-racemiform, sparingly glandular; bracts linear-lanceolate or

lanceolate, acute, short-hairy; sepals lanceolate, acute, short-hairy, 5–6 mm long; petals lilac, with purple nerves, 2–2.5(?) cm long, oblong, rarely lanceolate, acute, gradually tapering to long claw; filaments usually hairy nearly up to apex; style hairy; ovary densely hairy, with more or less short horns (4–9 mm in capsules), on 1–2 mm long stipe. June–July.

Open forests, shrubby formations, open stony slopes. — E. Siberia: Dau.; Far East: Ze.-Bu., Uss., Uda. Gen. distr.: E. Mong., Manchuria, Korea, N. China. Described from the Shilka and Argun rivers. Cotype in Leningrad.

2. *D. tadshikorum* Vved. nom. nov. — *D. turkestanicus* var. *bucharicus* Wint. in Bot. Mat. Gerb. Bot. Sada, V (1924) 159. — *D. albus* et *fraxinella* auct. Fl. As. Med. p.p.

Perennial; stems densely (especially below) short-crisp-hairy, 50–80 cm high; leaves imparipinnate, with (3)6–7(8) pairs of leaflets; rachis shortly crisp-hairy, nearly wingless; leaflets usually large, oblong or oblong-elliptic, usually short-attenuate above, acute, folded at margin, finely serrate, shortly crisp-hairy beneath, terminal leaflet cuneate-tapering to narrowly-winged petiole. Inflorescence racemiform-paniculate, distinctly glandular; bracts lanceolate or oblong-lanceolate, usually obtuse; sepals lanceolate or oblong-lanceolate, usually obtuse, 6–7 mm long; petals pinkish with purple
230 nerves, (2)2.5(3.5) cm long, lanceolate or oblong, obtuse, gradually tapering to long claw; filaments hairy below; style usually hairy; ovary more or less hairy, with short horns (in capsules 5–8 mm), on 1–1.5 mm long stipe. May–June.

Herbaceous and shrubby slopes in the central mountain belt. — Centr. Asia: Pam.-Al. (southern part). Endemic. Described from the Tirkoni village. Type in Leningrad.

Note. This species is closely related to the following species from which it differs mainly by its shorter, crisp pubescence. By this character it differs also from *D. himalayanus* Royle. Good and complete herbarium material is required for the clarification of all distinctions between these species. The population from the mountains of Samarkand, which differs from all the Central Asian specimens by the completely glabrous ovary, should be further studied.

3. *D. angustifolius* G. Don ex Sweet, Brit. fl. gard. 2 ser. I (1881) tab. 93; G. Don, Gen. syst. I (1881) 782; Fisch. et Mey. in Ind. VI sem Hort. Petrop. (1840) 49. — *D. Fraxinella* Lus. b. Ldb. Fl. Ross. I, 495. — *D. albus* ssp. *turkestanicus* Wint. in Bot. Mat. Gerb. Bot. Sada, V (1924) 158 (excl. var. *bucharica*); Kryl., Fl. Zap. Sib. VIII, 1854. — *D. albus* et *fraxinella* auct. Fl. As. Med. p.p. — Ic.: Sweet, l. c.

Perennial; stems more or less densely long-hairy, often glabrous below or rarely short-hairy, 50–100 cm high; leaves imparipinnate, with (3)5–6(7) pairs of leaflets; leaflets usually large, oblong or oblong-elliptic, usually long-attenuate above, acute, narrowly folded at margin, finely serrate, long-hairy beneath mainly along nerves and at base, sometimes completely glabrous, terminal leaflet cuneate-tapering at base, with narrowly winged petiole; rachis more or less long-hairy, nearly wingless. Inflorescence racemiform or racemiform-paniculate, distinctly glandular; bracts linear-lanceolate, acute, more or less short-hairy; sepals lanceolate-linear, acute,

more or less short-hairy, 7–8 mm long; petals lilac-pink, with purple nerves, (2.5)3.5–4.5 cm long, lanceolate or oblong, acute or obtuse, gradually tapering to long claw; filaments usually hairy; style usually glabrous; ovary more or less hairy, with long horns (in capsules (5)7–12 mm), on 1.5–2 mm long stipe; seeds 4–5 mm long. May–July.

Steppe meadows, shrubby formations, mountains in the south, herbaceous and shrubby slopes in the central mountain belt. — W. Siberia: Alt.; Centr. Asia: Dzu.-Tarb., T. Sh., Pam.-Al. (northern and eastern parts).

Gen. distr.: Kuldja. Description based on specimens cultivated from seeds from Altai plants. Type in London.

- 231 4. *D. caucasicus* Fisch. ex Grossh., Fl. Kavk. III (1932) 20. — *D. Fraxinella* var. *caucasica* Fisch. et Mey. in Ind. VI sem. Hort. Petrop. (1840) 49; Boiss. Fl. or. I (1867) 920 (excl. syn. Stev.). — *D. albus* ssp. *caucasicus* Wint. in Bot. Mat. Gerb. Bot. Sada, V (1924) 158. — *D. albus* et *fraxinella* auct. p.p. — Exs.: Herb. Fl. Cauc. No. 333.

Perennial; stems sparingly short-crisp-hairy, always glabrous below, 50–80 cm high; leaves imparipinnate, with (3–4)5–6(8) pairs of leaflets; leaflets usually small, oblong-lanceolate or rarely oblong-elliptic, tapering at apex, acute, serrate, shortly crisp-hairy beneath, mainly along nerves, terminal leaflet with more or less winged petiolule, rachis shortly crisp-hairy, more or less winged. Inflorescence paniculate-racemiform or racemiform, more or less glandular; bracts lanceolate or oblong-lanceolate, acute or obtuse, long-hairy; sepals lanceolate or oblong-lanceolate, acute or obtuse, long-hairy, 5–7 mm long; petals apparently pinkish-lilac, with purple nerves 2–2.5(3) cm long, oblong, abruptly tapering to relatively short claw; filaments hairy below; style glabrous; ovary more or less hairy or glabrous, with short horns (in capsules 2–4 mm long), with many stalked glands, on 2–3 mm long stipe. June–July.

Steppes, shrubby formations, open forests. — European part: M. Dnp. (western part), L. Don, Transv.; Caucasus: Cisc., Dag., E. and S. Transc. **Gen. distr.:** NW Iran. Described from Besh-Tau. Type in Leningrad.

Note. There is scanty and incomplete material from the western part of the Middle Dnieper area,* and thus identifying it with *D. caucasicus* is rather doubtful, particularly since Montrezor's specimens (only plant-tops) from Negin have stems with solitary hairs. It should also be noted that many plants from Transcaucasia have larger leaflets and longer hairs and have to be further studied. There is no question that the Bessarabian population represents a separate unit, but there is not enough material for a precise determination.

5. *D. gymnostylis* Stev. in Bull. Soc. Nat. Mosc. XXIX, 1 (1856) 333. — *D. Fraxinella* lus. a Ldb. Fl. Ross. I (1842) 495. — *D. albus* ssp. *gymnostylis* Wint. in Bot. Mat. Gerb. Bot. Sada, V (1924) 157. — *D. albus*, *fraxinella* et *caucasicus* auct. quoad pl. taur. — Exs.: G.R.F. No. 768; Dörf. Herb. Norm. No. 5242.

Perennial; stems densely long crisp-hairy down to base, 40–80 cm high; leaves imparipinnate, with (2)3–4(5) pairs of large leaflets; leaflets elliptic

* Plants of the W. Ukraine probably refer to *D. albus* L. (Editors).

232 or oblong-elliptic, rarely oblong, usually not tapering at apex, obtuse or acute, serrate at margin, more or less densely long-hairy beneath, the terminal leaflet more or less rounded, with narrowly winged petiolule; rachis densely long-hairy, narrowly winged. Inflorescence racemiform, rarely paniculate-racemiform, more or less glandular; bracts lanceolate, acute, long-hairy; sepals lanceolate, acute, 5–7 mm long; petals pinkish, with purple nerves, 2.5–3 cm long, oblong, acute, abruptly tapering to relatively short claw; filaments hairy at base; style glabrous; ovary usually glabrous, very rarely hairy above, nearly hornless or with short horns (in capsules 1–3 mm), with few stalked glands, on (2)3–4(5) mm long glabrous stipe. May–June. (Plate XI, Figure 1.)

Open forests, shrubby formations. — European part: M. Dnp. (southeastern part), V.-Don (southern part), L. Don (western part), Crim.; Caucasus: Cisc. (western part), W. Transc. Endemic. Described from the Crimea. Type in Helsinki.

Subfamily 2. **TODDALIOIDEAE** Engl. — Flowers 4–5-merous, unisexual, plants dioecious; stamens as many as petals; fruit a samara or drupe.

Genus 846. **PHELLODENDRON** * Rupr.

Rupr. in Bull. Phys.-Math. Ac. Pétersb. XV (1853) 353

Flowers unisexual in dioecious plants, male flowers with rudimentary ovary, female with staminodes; sepals 5; petals 5, pubescent inside; stamens 5, alternate to petals, with anthers opening inside; ovary 5-locular with one ovule in each cell; style 1, with capitate 5-lobed stigma; fruit an aromatic drupe usually with 5 stones. Trees with imparipinnate leaves.

The genus *Phellodendron* includes fossils as established by the seeds found. *Phellodendron* sp. in Myocene layer of the Volga-Kama (Solikamsk).

1. *P. amurense* Rupr. in Bull. Phys.-Math. Ac. Pétersb. XV (1853) 3, 53; Maxim. in Mém. Acad. Pétersb. sav. étr. IX (1859) 72, tab. 4; Kom. in Tr. B. S. XXII (1904) 668; Sarg. Trees and Shrubs. I (1905) 197, tab. 93; Schneid. Laubholz. II (1907) 124; Kom. and Alis., Opređel. r. Dal'nevost. kr. II, 696; tab. 209. — Ic.: Maxim. l. c.; Sarg. l. c.; Kom. and Alis. l. c. — Amur cork-tree.

233 Tree with dense crown 10–15 m high; bark pale gray, wrinkled, velutinous; leaves alternate below, above opposite, petiolate, imparipinnate, with 3–6 pairs of leaflets; leaflets petiolulate, lanceolate, oblong-lanceolate or oblong, long-tapering at apex, acute, finely crenate, more or less ciliate, when young more or less hairy, later subglabrous. Inflorescence paniculate, with slightly hairy branches, ebracteate; sepals ovate-triangular, acute, glabrous or ciliate, 1–2 mm long; petals greenish, oblong or elliptic, acute, 3–4 mm long; stamens $1\frac{1}{2}$ to 2 times as long as petals; drupe globose, black. June–July. (Plate XIII, Figure 1.)

* From the Greek *fellos* — cork, and *dendron* — tree.

Forests in valleys and mountains. — Far East: Ze.-Bu., Uda, Uss. Sometimes cultivated in the European part, Centr. Asia and in the Caucasus. **Gen. distr.:** Jap.-Ch. Described from the Amur River. Type in Leningrad.

Economic importance. The velutinous bark is used in the manufacture of cheap corks. The wood is used for making furniture (Strogii. Tr. po prikl. bot. XXI, 55–144; Maleev., Sov. bot. 5, 1933, 11–19).

Genus 846a. **SKIMMIA** Thunb. — See p. 543

Genus ★ **PTELEA** * L.

L. Sp. pl. (1753) 118; Gen. pl. ed. 5 (1754) 54

Flowers unisexual in dioecious plants, male flowers with rudimentary ovary, female with staminodes; sepals 4–5; petals 4–5; stamens 4–5; ovary 2-locular, with 2 ovules in each cell; style 1, with capitate stigma; fruit a 2-seeded samara. Shrub, with ternate, foul-odored leaves.

1. *P. trifoliata* L. Sp. pl. (1753) 118; Schneid. Laubholzk. II (1907) 123, f. 77, 78, f; Wils. in N. Am. Fl. 25 (1911) 209. — Ic.: Sarg. Sil. N. Am. I (1901) tab. 33, 34.

Shrub 1.5–3 m, up to 8 m in nature; leaves long-petioled, ternate; leaflets lanceolate, oblong or ovate, the lateral sessile, tapering above, entire or finely dentate, glabrous or pubescent when young. Inflorescence paniculate, with pubescent branches and pedicels; sepals ovate or oblong, pubescent or glabrous, 1–2 mm long; petals greenish-white, elliptic or sometimes oblanceolate, obtuse or acute, more or less pubescent outside, 4.5–6.5 mm long; filaments usually hairy below middle; samara oval, obovate or suborbicular, 1.5–3 cm wide. July–August. (Plate XIII, Figure 2.)

Cultivated in the southwestern part of the USSR as an ornamental plant. Native habitat. — N. America. Described from Virginia.

Subfamily 3. **AURANTIOIDEAE** Engl. — Flowers 4–5–8-merous, usually bisexual; stamens 8 to many, free or polyadelphous; fruit (hesperidium) baccate, cells filled with juice-sacs.

234 Genus ★ **PONCIRUS** Raf.

Raf. Syl. Tell. (1838) 143

Flowers bisexual; sepals 4–5(6–7), connate at base; petals 4–5(6–7), spatulate, clawed; stamens 8–10, free; ovary 6–8-locular, with numerous ovules; fruit baccate, with densely hairy soft pericarp, locules containing stalked juice sacs filled with oily, bitter substances. Spiny shrubs, with ternate deciduous leaves.

* The name for elm used by the ancient authors.

1. *P. trifoliata* (L.) Raf. Syl. Tell. (1838) 143; Kom. in Tr. Prikl. Bot. XXVI, 1 (1931) 343. — *Citrus trifoliata* L. Sp. pl. ed. 2 (1762) 1101; Schneid. Laubholz. II (1907) 128. — *Aegle sepiaria* DC. Prodr. I (1824) 538. — *C. triptera* Desf. Cat. Hort. Paris, ed. 3 (1829) 406. — *Pseudaegle sepiaria* Miq. Ann. Mus. Lugd.-Bat. II (1865–1866) 83. — Ic.: André in Rev. Hort. 57 (1885) 516. — Trifoliate orange.

Shrub, with green flattened branches; leaves coriaceous, with winged petiole, ternate, with sessile obovate leaflets. Flowers large, white, subsessile, axillary; fruit subglobose, up to 5 cm wide, with numerous seeds. March–April. (Plate XIV, Figure 2.)

Cultivated mostly in the Caucasus as stock for citrus fruits, also for ornamental purposes and as a hedge plant. Its native habitat is C. China and the Himalayas. Described from Japan.

Note. The most cold-resistant among the citrus plants, hence used for crossing with them. The known citranges of these hybrids are *Citrus sinensis* × *Poncirus trifoliata* and (*C. sinensis* × *P. trifoliata*) × *Fortunella* sp. satsumas (*P. trifoliata* × *C. unshiu*), and others.

Genus ★ CITRUS * L.

L. Sp. pl. (1753) 782; Gen. pl. ed. 5 (1754) 341

Flowers bisexual or some male-abortive; sepals 4–5-, more or less connate; petals 4–8, fleshy, oblong-linear; stamens 20–60, free or polyadelphous; ovary 8 to locular, with 4–8 biseriate ovules in each cell; fruit baccate, with glabrous soft pericarp, locules filled with stalked juice sacs; seeds with 2 to many embryos. Small trees, with evergreen (unifoliolate) leaves.

- 237 1. Young branches reddish-violet; petals faintly purple outside; fruit ovoid or oval, with beak (nipple) at apex, pale yellow, with peel not easily separating 1. *C. limon* Burm.
+ Young branches green; petals pure white; fruit globose, flattened or depressed at apex, bright orange-yellow, with readily separating peel 2. *C. unshiu* Marc.

1. *C. limon* Burm. Fl. ind. (1768) 173; Luss in Tr. Prikl. Bot. XXVI, 1 (1931) 179. — *C. medica* β. *Limon* L. Sp. pl. (1753) 782. — *C. limonum* Risso in Ann. Mus. Hist. Nat. 20 (1813) 201; Mark. in Izv. Soch. obl. and Sukhum. sad. i s.-kh. opyt. st. 2 (1921) 7 et 10. — Ic.: Bonnier, Fl. III. Fr. II (1912) tab. 111, f. 578.

Small spiny shrub; young shoots with reddish-violet tinge; leaves coriaceous, oblong-ovate or oblong-lanceolate, acute, finely dentate, with wingless petiole. Flowers axillary, solitary or in pairs; calyx obscurely dentate; petals faintly purple outside, distinctly curved, glabrous; stamens free or united in small bundles; style not detached from ovary; fruit ovoid

* From the Greek *kitron*, *kitrion* — a word of African derivation.



PLATE XIII. 1 — *Phellodendron amurense* Rupr.; 2 — *Ptelea trifoliata* L.

or oval, tapering at both ends, with nipple at apex, pale yellow, peel not easily separating, core-compact; seeds thick, pinkish at the chalaza, with faintly greenish solitary embryo. February–April.

Cultivated in the Caucasus and sheltered during the winter in Astara district and the coast of Batumi. Native habitat – Pacific tropical islands. Described from the Near East. Widely cultivated in the Mediterranean countries.

2. *C. unshiu* Marc. in *Izv. Soch. obl. i Sukhum. sad. i s.-kh. opyt.* st. 2 (1921) 5 and 11; Luss in *Tr. Prikl. Bot.* XXVI, 1 (1931) 205; Tanaka in *Mem. Fac. Sc. Agric. Taihoku Univ.* IV (1932) 51, tab. I, f. 3, 4c. – *C. unshiu* Hort. ex Tanaka in *Int. Rev. Sc. Prag. Agr. N.S.* I (1923) 32. – *C. nobilis* var. *unshiu* Swing. in *Bailley Stand, Cycl. Hort.* 2 (1915) 784. – *Id.*: Tanaka, l. c.

Small, nearly dwarf, robust, loosely spreading, usually not spiny, commonly grayish with brown-striped branches usually inclined, drooping at tip; young shoots dark green, angular, often flexuose; leaves coriaceous, shiny above, dull beneath, large, oblong, abruptly and shortly tapering at apex, with distinctly prominent nerves and hardly winged petioles. Flowers axillary, usually solitary or in pairs; petals pure white, thick, moderately tapering; stamens connate at base, grouped in bundles, often with abortive anthers; fruit globose-flattened, bright orange-yellow, depressed at apex, peel easily separating, core loose, usually with solitary seeds or none; seeds turbinate, without distinct beak, whitish, with few green pale embryos. February–April. (Plate XIV, Figure 1.)

Note. *C. unshiu* is the major citrus fruit grown in the Caucasus where tangerines have been cultivated since the end of the 19th century. It is unknown in its wild state and, according to Tanaka, represents a mutation of the semicultivated Chinese variety of tangerines growing in Chekiang province. It is widely cultivated in Japan from where it has been spread into cultivation in the world. There are many varieties of this species but the most widespread in the USSR is the satsuma orange (Ekimov and Korotkova. *Subtrop.*, 3–4, 1929, 23–27; Korotkova. *Tr. Prikl. Bot.* XXIV, 4, 1929–1930, 395–422; Luss, *Tr. Prikl. Bot. ser. A.* 8, 1933, 43–68).

Among the other representatives of the genus *Citrus* cultivated in the Caucasus there are: 1) *C. sinensis* Osbeck (orange). Petioles narrowly winged; flowers white, in few-flowered corymbs, with glabrous calyx; fruit globose, orange, with core compact and not easily separating peel, pulp sweet-sour. 2) *C. aurantium* L. (Seville orange). Petioles broadly winged; flowers white in few-flowered corymbs, with pubescent calyx; fruit subglobose, orange, with hollow core and not easily separating peel, pulp bitter. 3) *C. deliciosa* Ten (mandarin orange). Leaves more or less gradually acuminate; petioles wingless; flowers white, solitary; fruit flattened, furrowed at base, dark orange, with loose core and easily separating peel. 4) *C. paradisi* Mactad. (grapefruit). Petioles winged; flowers in many-flowered racemes; fruit flattened, depressed and dotted at apex, dark yellow. 5) *C. medica* L. (citron). Petioles wingless; flowers with reddish tinge, solitary or in few-flowered racemes, glabrous; fruit oblong, irregular, rugose and grumose, obtuse, yellow, with very thick peel, pulp sour-bitter. 6) *C. limetta* Risso (sweet lime). Petioles wingless or slightly winged; flowers white, small, glabrous; fruit



PLATE XIV. 1—*Citrus unshiu* Marc.; 2—*Poncirus trifoliata* (L.) Raf.; 3—*Fortunella japonica* Swing.

broadly oval or globose, with broad nipple, yellow, pulp sweet. 7) See Markovich (l. c.) for other citrus fruits.

Genus ★ **FORTUNELLA** Swing.

Swing, in Journ. Wash. Ac. Sc. V (1915) 165

Flowers bisexual; calyx 5-toothed; petals (4)5(6); stamens 18–20, irregularly connate, in bundles; ovary 3–7-locular, with 2 ovules in each 241 cell; fruit baccate, small, with glabrous fleshy peel and locules filled with stalked juice sacs. Shrubs or small trees, with evergreen (unifoliate) leaves.

1. *F. japonica* (Thunb.) Swingle in Journ. Wash. Ac. Sc. V (1915) 171; Luss in Tr. Prikl. Bot. XXVI, 1 (1931) 227. — *Citrus japonica* Thunb. Fl. japon. (1784) 292. — *C. auranticum* var. *japonica* Hook. in Bot. Mag. 3 ser. XXX (1874) tab. 6128. — Ic.: Rgl. in Gartenfl. XXXI (1882) tab. 1097.

Spiny shrub or small tree; young branches green, glabrous, flattened-triangular; leaves coriaceous, oblong-lanceolate, tapering, obtuse, cuneate at base, slightly crenate, with narrowly winged petiole. Flowers 1–3 in axil; calyx glabrous; petals white, oblong; fruit orange, globose, 5–6-locular, 2.5–3 cm wide. March–April. (Plate XIV, Figure 3.)

Cultivated in the Caucasus. Native habitat. — China. Described from Japan. Widely cultivated in Pacific Asia.

Note. Resembling *F. margarita* (Lour.) Swing. that differs by the oval, 4–5-locular fruit and obsolete spines.

Family LXXXIV. **SIMARUBACEAE** * LINDL.

Trees or shrubs; leaves alternate, rarely opposite, pinnate, rarely simple. Flowers bisexual or unisexual, regular, usually small, in panicles or spicate inflorescences; sepals 3–5, more or less connate, imbricate or valvate; petals 3–5(6), rarely absent; stamens commonly twice as long as petals; ovary superior, usually encircled by inflated disk composed of 2–6 carpels, free at base or connate by styles (or stigmas) or completely connate; carpels 1- to few-seeded; fruit drupaceous, rarely a berry or samara; seeds thinly albuminous or exalbuminous.

Note. A tropical family with 30 genera and nearly 200 species. Most of the genera are confined to the tropical regions. Only one representative of this family is encountered in cultivation in the USSR.

* Treatment by I.A. Linchevskii.

Genus ***AILANTHUS*** Desf.

Desf. in Hist. Acad. Sc. Par. (1786-1788) 265 (nom. conserv.).— Pongelion Adans. Fam. II (1763) 319

Rather large trees; buds subspherical, with 2-4 scales; leaves deciduous, alternate, imparipinnate; leaflets 9-41, usually denticulate at base, 242 teeth bearing a rather large gland. Flowers small, bisexual and staminal, in large terminal panicles; sepals 5, small, connate; petals 5-6; stamens 10, inserted at base of 10-lobed disk; staminal flowers without rudimentary gynoecium; carpels 5-6, more or less connate or free; fruit composed of 1-6 free oblong samaras with compressed seed in the middle; seeds thinly albuminous; embryo with obovate or suborbicular cotyledons.

Note. This genus comprises 12-15 species occurring in the southern part of the Himalayas and reaching N. China (Shansi, Hopeh); it is also found in Ceylon, Sumatra, Java, Moluccas island group, Australia, (Queensland and New South Wales), and the Philippines.

Ailanthus was distributed in the USSR from the Paleocene to the Myocene.

A. confucii Ung. in Paleocene deposits of the Amur (Raichikha), in Sarmatian deposits of the Black Sea area (Krynka).

**A. altissima* (Mill.) Swingle in Journ. Wash. Acad. Sc. VI (1916) 495; Rehd. Man. cult. trees (1937) 527; Grossg., Fl. Kavk. III, 21.— *Toxicodendron altissimum* Mill. Gard. Dict. ed. 8 (1768).— *Albonia peregrina* Buc'hoz Herb. color Amér. (1783) tab. 57.— *Rhus sinensis* Houttuyn, Handl. Pl. II (1774) 212.— *Rh. cacodendron* Ehrh. in Hannov. Mag. XXI (1783) 225.— *Ailanthus glandulosa* Desf. in Hist. Acad. Sc. Par. 1786 (1788) 265 C.K. Schn. Laubholz. II, 130; Kom., Fl. Man'chzh. II, 673; Shmal'g., Fl. I, 203; Hegi, III, Fl. V, 1, 81; Madaus, Lehrb. Biol. Heilmitt. I (1938) 452.— *A. peregrina* Barkley in Ann. Mo. Bot. Gard. XXIV (1937) 264.— *Pongelion glandulosum* Pierre, Fl. Cochinch. IV (1893) 294.— Ic.: Desf. l. c. tab. 8; Hegi, l. c. f. 1717, 1718; Engl. u. Pr. Nat. Pflanzen.-fam. 2 Aufl. 19a (1931) 390, f. 182; Madaus, l. c. p. 452.

Tree, up to 20-30 m high, with rather loose spreading crown; young branches slightly pubescent, later dull, yellowish-brown, old bark pale gray; leaves (30)45-60(90) cm long; leaflets 11-25(41), oval-lanceolate or ovate-lanceolate, rounded at base, slightly emarginate or (rarely) obliquely truncate, (4)6-12 cm long, 2.5-4 cm wide, densely and shortly pubescent when young, later subglabrous, finely ciliate at margin, with 2-4 large teeth at the lower part of blade each bearing a gland. Flowers in loose panicles, 10-20(30) cm long, bisexual and staminal; sepals 5, very small, connate below; petals 5-6, greenish-yellow, 2.5-3.5 mm long, acuminate-ovate, crisp-hairy inside at the lower half; stamens 10, ca. 4 mm long, filaments pubescent below; ovary of 5 one-seeded carpels, with connate styles; fruit 243 a flattened, oblong samara, irregularly rhombic in shape, 3-4 cm long, ca. 1 cm wide, straw-yellow or reddish-brown, with 1 seed in the middle. Fl. May, Fr. July-August.

Escaped in China (provinces of Kansu, Szechwan, Shantung, Hopeh, Hupeh) from which it was dispersed to W. Europe in the 18th century and later naturalized in America.

* From *aylanto*, a vernacular name used by Rumpf (Rumpf, Herb. Amb. III (1743) 203) to describe "Arbor coeli."

Description based on cultivated specimens grown in England from seeds sent from China by missionary Incarville in about 1750. Type unknown (?).

Economic importance. *A. altissima* (Mill.) Swingle is often grown in the USSR as a shade tree, particularly in the south: Crimea, Black Sea coast of the Caucasus, N. Caucasus, Transcaucasia, Turkmenistan, Tadzhikistan, Uzbekistan, S. Kirghizia, S. Kazakhstan. It frequently escapes from cultivation. In Central Asia it is cultivated under irrigated conditions but it has been discovered that it grows satisfactorily under nonirrigated conditions: on loess hills near Tashkent, Samarkand and Stalinabad, and in many other places it is grown as a shade tree under nonirrigated conditions. It has withstood the more northern climates, Leningrad, for example, but in severe winters is destroyed by frost.

In addition to being a shade tree it is planted because of the beauty of its leaves, the rather original type of crown, rapid growth and its ornamental fall fruits, especially of var. *erythrocarpa* Rehd.; the leaves of *A. altissima* are used to feed the silkworm *Attacus cynthia* which was domesticated in some of the provinces of China and from there has been dispersed to India, S. Europe and America. The quality of the silk obtained from *Attacus cynthia* is inferior to that obtained from the Chinese silkworm.

In the literature there are reports that the bark and leaves of *A. altissima* are effective in the treatment of tapeworm and dysentery. In a recent article on the medicinal plants of China, B. E. Read (Chinese Medicinal Plants, Publ. Peking Nat. Hist. Bull. 1936) points out that the bast is used for medicinal purposes since it contains fatty oil, phlobaphene, phytosterol and tannin. Its seeds and roots are used as well. Hegi (l. c.) notes that the wood of *A. altissima* is not easily split, but is easily processed. In China it is used for building and also in the manufacture of paper. Both bark and leaves contain anthelmintic constituents. The leaves contain quercetin and 11.9% tannin substances (ellagitannin and gallotannin). The resinous sap of the bark is used in preparing oil plants.

244 The local population in some parts of S. Central Asia regard the leaves as a means of treating Pindinski ulcer.

Family ★**MELIACEAE*** VENT.

Trees or shrubs, rarely semishrubs or herbs; leaves alternate, rarely opposite, pinnate, rarely simple. Flowers regular, bisexual, rarely unisexual, usually in terminal inflorescences; sepals 4–5, usually partly connate; petals 4–5, rarely 3–10, valvate, imbricate or convolute, free or sometimes connate at base; stamens usually 8–10, usually united into a tube, rarely free; ovary superior, united at base with disk, 2–5-locular, rarely 1- or 10–20-locular, with 1–2 or rarely more embryos in each cell; fruit a capsule, drupe or berry; seeds winged or wingless, with or without albumin.

* Treatment by I. A. Linchevskii.

Note. There are ca. 40 genera and nearly 600 species in this family, mainly restricted to tropical and subtropical regions.

Genus ★ **MELIA** * L.

L. Gen. pl. ed. 5 (1754) 182

Trees or shrubs with deciduous leaves or evergreen; leaves bipinnate or tripinnate, with entire or dentate leaflets. Flowers in terminal panicles, bisexual; sepals 5–6, small, connate at base; petals 5–6, free; filaments united into a thin tube with 10–20 lobes at top, anthers 10–12, borne inside tube between lobes; ovary on short disk, with long cylindrical style, 5–8-locular, each cell with 2 ovules; fruit a drupe with fleshy or more or less dry pericarp.

Note. There are about 25 species in S. Asia and Australia.

*M. azedarach*** L. Sp. pl. ed. 1 (1753) 384; DC. Monogr. Phan. I (1878) 451; Boiss. Fl. or. I, 954; Hook. Fl. Brit. Ind. I, 544; Brandis, Ind. Trees, 140; C.K. Schn. Laubholz. II, 132; Rehd. et Wils. in Sarg. Pl. Wilson, II, 4, 157; Burkill, Dict. Econ. products Malay penins. II (1935) 1441; Rehd. Man. cult. trees, 528; Hegi, Fl. V, 1, 85; Makino and Nemoto, Fl. of Jap. (1931) 636. — *M. japonica* Don, Gen. Syst. I (1831) 680. — *M. azedarach* var. *japonica* Makino in Bot. Mag. Tokyo, XXVIII (1914) 34. — Ic.: Lindl. Med. Oecon. Bot. (1849) 116; C.K. Schn. l. c. f. 83, 84; Hegi, l. c. f. 1719.

245 Tree up to 12–18 m high, with rather broad spreading crown; bark of young branches reddish-brown, of the older dark gray, rugose; leaves 25–80 cm long, bipinnate or tripinnate; leaflets 3–12, 2–5 cm long, 1.5–2.5 cm wide, ovate or oval, acuminate, acutely or obtusely dentate at margin, pale green, glabrous, slightly puberulent when young. Flowers with strong smell of honey, lilac, ca. 2 cm in diameter, in loose panicles 10–20 cm long; sepals 5, hardly connate at base, triangular-ovate, glandular-hairy, ca. 2 mm long; petals 5, pale lilac, lanceolate, ca. 1 cm long, ca. 2 mm wide; staminal tube dark violet, 8–9 mm long, ca. 1.5 mm in diameter, with few papillae outside in upper part, with 20 subfiliform lobes above and 10 anthers between them; ovary with the cylindrical style ca. 5 mm long; fruit a fleshy yellow drupe ca. 1.5 cm in diameter, 5-locular. Fl. May, Fr. October.

Escaped from cultivation in South and Southeastern Asia (Himalayas, Central and South China, Japan, and others), New Guinea, Australia. Boissier (l. c.) cites Buser's data recording it (apparently incorrectly) escaping in Gilan and Mazanderan. Its cultivation started in the 16th century and is now known in all the tropical and subtropical regions of the Old and New Worlds. In the USSR it is sometimes found in the southern regions — Crimea, Caucasus, Central Asian Republics. Described from specimens obtained by Linnaeus, apparently from Syria. Type in London.

* From the Greek *melia* — ash, for the similarity of the leaves with those of the ash.

** Arabic name for this tree, borrowed by Linnaeus from Avicenna.

Economic importance. Grown as an ornamental tree for its unique leaves and flowers and the beauty of its crown. It is distinguished for its rapid growth and hard, light red wood which is widely used for carpentry in some countries, sometimes in place of the real "redwood" (*Swietenia mahagoni* Jacq.), which belongs to the same family. B. E. Read (Chinese Medicinal Plants. Publ. Peking Nat. Hist. Bull. 1936) includes *M. azedarach* L. among the medicinal plants, noting that the fruits, bark, leaves and flowers are in use. The fruits contain 60% fatty oil (from the seeds) and 6% tannin. According to Lindley (l. c.) the ground roots are used in the United States as an anthelmintic agent. Hegi (l. c.) writes that not only the roots can be used for that purpose but the whole plant as well. He notes that the oil of *M. azedarach* may be used for varnishes and that the wood is utilized in the manufacture of musical instruments.

Burkill (l. c.) observes that the Arabs and Iranians use the liquor from the leaves as anthelmintic, diuretic and emetic remedies. The fruit (seeds) are poisonous for man. There were cases in Java where the seeds were
246 used for poisoning. In China they are used as a poison for fish, and in America insecticides are prepared from the fruit.

Family LXXXV. **POLYGALACEAE** * LINDL.

Flowers bisexual, zygomorphic; calyx of 5 free or more or less connate sepals, the two lateral (inner) sepals petaloid, the others much smaller, the dorsal unpaired, cup-shaped, usually slightly longer than the two anterior; petals 5, the two lateral abortive or obsolete, the anterior often large and keeled, fimbriate at apex and more or less united with the others; stamens 8, filaments united for half into a tube separated below; anthers 1-locular, opening by terminal pore; ovary superior, usually 2-locular, with 1 pendent ovule in each cell; style 2-lobed at apex, sometimes capitate; fruit a 2-locular capsule flattened at the sutures; seeds hairy, with conspicuous aril, endosperm and erect embryo. Perennial herbs, with alternate entire leaves; flowers in terminal and axillary racemes.

Genus 847. **POLYGALA** ** L.

L. Sp. pl. ed. 1 (1753) 701

Inflorescence a raceme. Flowers irregular; sepals 5, persistent (in Russian species), the inner two (lateral) petaloid, larger in fruit, winglike; petals usually 3 (rarely 5), more or less united to each other and with filaments, the lower petal boat-shaped, fimbriate-incised above (in Russian species); stamens 8, rarely 6, united below in one bundle, separating above into two bundles consisting of 4 stamens each or monadelphous; anthers

* Treatment by S.A. Nevskii. The manuscript was edited and enlarged by S.G. Tamamshyan with the data of M.I. Kotov.

** From the Greek *polys* — many, and *gala* — milk. It was once thought that the abundance of this plant would increase the lactation of animals in pastures.

1-locular, opening by small pore at apex; ovary superior, 2-locular, with 1 style and 2-lobed stigma; fruit a 2-locular capsule, flattened at sutures, usually winged at margin; seeds one in each cell, hairy arillate. Perennials with entire, alternate, sometimes whorled leaves, without stipules; flowers with 3 bracts, of which the median longer.

The so-called "Radix Senegae" which is the root of *P. senega* L., an American species of this genus, is widely known in medicine. Extracts of this root are among the mixtures used for gargling and also as a diuretic and diaphoretic. These are also the properties of the root of the Russian *P. sibirica* L. and *P. tenuifolia* Willd. In America the root is also applied in the treatment of snake bite.

At present the root of *P. senega* is of less use, having been replaced by other and more perfect means.

1. Filaments half-connate, sometimes only the median two united up to base of anthers or all wholly connate; style twisted above middle, filiform or ribbonlike, angustate above and below; stigma orbicular 2.
- + Filaments connate nearly up to anthers; style straight, stigma 2-lobed, cochleariform, sometimes hairy above 4.
2. Stems glabrous or subglabrous; leaves narrowly linear, up to 3 cm long and 0.5–1 cm wide 2. *P. tenuifolia* Willd.
- + Stems shortly appressed-hairy; leaves lanceolate, elliptic or ovate 3.
3. Flowering raceme distinctly shorter than the leafy shoot; capsule with deep depression above; filaments connate 3. *P. japonica* Houtt.
- + Flowering raceme much longer than the leafy shoot; capsule with inconspicuous depression above, narrowly winged; stamens free 1. *P. sibirica* L.
4. Anthers of median stamens densely hairy above, longer than the others; crest longer than upper petals, wings never netted-veined 5.
- + All anthers glabrous, uniform; upper petals shorter or as long as crest 7.
5. Plants slightly woody at base; flowers blue but not large; wings of capsule symmetrical or somewhat asymmetrical 6.
- + Semishrubs with woody stems; flowers large, bright pink to purple; wings of capsule much asymmetrical with protuberant nerves 4. *P. papilionacea* Boiss.
6. Capsule oblong, with narrow wings, not completely symmetrical, as wide as or slightly wider than wings of flowers 5. *P. hohenackeriana* Fisch. et Mey.
- + Capsule broadly cordate, broadly and symmetrically winged, much wider than wings of flowers 6. *P. stoksiana* Boiss.
7. Anthers on more or less long or short but distinct stalks [filaments?]; wings nearly never netted-veined 8.
- + Anthers not as above; wings always distinctly or faintly netted-nerved, sometimes with dense reticulum in the upper part 11.

8. Erect plants; anthers on very distinct stalks [filaments?]; wings of corolla elliptic, acuminate; leaves lanceolate 10. *P. pruinosa* Boiss.
- + Procumbent or slightly ascending plants; anthers on inconspicuous stalks; lower sepals helmet-shaped 9.
9. Small plants, appressed to ground; leaves small, orbicular, dense; wings (inner sepals) elliptic, acuminate or obtuse; capsule narrowly winged 8. *P. andrachnoides* Willd.
- + Plants larger, prostrate or ascending; leaves broadly elliptic or obovate; capsule irregularly winged 10.
10. Stems ascending; leaves broadly elliptic; lobes of aril broadly ovate, short, one-fifth as long as seed 9. *P. pseudohospita* Tamamsch.
- + Stems decumbent, woody at base, frutescent; lower leaves and some of the median broadly lobate; wings of flowers asymmetrical; lobes of aril one-third as long as seed 7. *P. supina* Schreb.
11. Plants with rosetted or radical leaves 12.
- + Plants not as above 14.
12. Rosette leaves and cauline leaves distinctly differing in shape and size 13.
- + Cauline leaves similar to leaves of rosette; flowers greenish-white, small; wings 2.5 mm, shorter than capsule 11. *P. austriaca* Crantz.
13. Wings longer than capsule post anthesis; inflorescence rather dense; flowers larger, up to 4–5 mm; upper cauline leaves acuminate 12. *P. subamara* Fritsch.
- + Wings shorter than or as long as capsule; flowers blue, small, 2–3 mm; cauline leaves lanceolate, sessile 13. *P. amarella* Crantz.
14. Corolla slightly longer than wings; ovary and capsule distinctly . . . stipitate 21.
- + Corolla as long as or shorter than or slightly longer than wings; ovary and capsule nearly always sessile, infrequently stipitate 15.
15. Small, low plants up to 10 cm high; leaves small, ovate or orbicular; corolla tube short, much curved 14. *P. suanica* Tamamsch.
- + Higher plants; leaves longer than 2 cm; corolla tube straight, as long as limb 16.
16. Leaves broadly lanceolate or rhombic, thick, shiny; corolla not protruding from wings; wings obovate, obtuse, with nerves slightly anastomosing above 15. *P. alpicola* Rupr.
- 249 + Leaves thin, linear or narrowly lanceolate; corolla up to 8 mm long, as long as wings or slightly exceeding them 17.
17. Racemes with apical pappus of long bracts 19.
- + Bracts caducous, racemes without apical pappus 18.
18. Inflorescence short; all bracts subequal, very small; leaves lanceolate; flowers pinkish or blue; wings narrowly lanceolate; plants of the central and lower mountain zones 16. *P. caucasica* Rupr.

- + Two lateral bracts shorter than flower bud, median bracts as long as pedicel; leaves linear; W. European plants 17. *P. vulgaris* L.
19. Racemes pyramidal-conical, dense, not very long; flowers pinkish, blue and white; corolla as long as wings 18. *P. hybrida* DC.
- + Racemes loose, long, not conical or pyramidal; flowers pinkish, pale purple or pale violet 20.
20. Wings elliptic; ovary and capsule sessile 19. *P. comosa* Schkuhr.
- + Wings oblong-elliptic; ovary distinctly stipitate 20. *P. moldavica* Kotov.
21. Ovary and capsule stipitate, stipe as long as or longer than fruit 22.
- + Ovary and capsule on shorter stipes 26.
22. Stipe longer than ovary and fruit; very large plants, up to 50–60 cm high 23.
- + Ovary and fruit as long as stipe; plants not as large 25.
23. Plant up to 60 cm high; flowers large, 19–21 mm, lilac; wings broadly elliptic, 5–7-nerved . . . 21. *P. amoenissima* Tamamasch.
- + Flowers smaller, 10–17 mm; corolla pale purple, pinkish, sometimes blue 24.
24. Ovary on stipe nearly twice as long as ovary; flowers pale purple; corolla not conspicuously exceeding wings; stems few, woody at base 22. *P. cretacea* Kotov.
- + Ovary on a slightly longer stipe; corolla distinctly exceeding wings, up to 14–15 mm long; wings broadly lanceolate, 3–5-nerved 23. *P. major* Jacq.
25. Racemes loose; wings narrowly lanceolate, acuminate; corolla distinctly protruding from wings, tube sword-shaped, curved, narrow; flowers white and pink; delicate plants 24. *P. colchica* Tamamsch.
- + Racemes dense; wings elliptic, sometimes mucronate; corolla protruding from wings, tube weakly curved; flowers white and pinkish; many-stemmed plants 25. *P. mariamae* Tamamsch.
- 250 26. Racemes terminal and axillary, very long, more than half as long as entire shoot; flowers up to 8 mm long, straw-yellow, yellowish when dry, very rarely reddish 26. *P. leucothyrsa* Voron.
- + Racemes only terminal, not as long; flowers never yellowish, up to 12–13 mm 27.
27. Bracts long persistent, young inflorescence with pappus; corolla tube straight or nearly so 28.
- + Bracts caducous; corolla tube curved, longer than limb 29.
28. Leaves broadly rhombic, shiny, coriaceous; flowers bright blue (nearly gentian); corolla tube straight, broad; stems many, erect, woody at base 27. *P. urartu* Tamamsch.
- + Leaves linear-lanceolate or linear; flowers pinkish or blue; stems few, ascending 28. *P. kemulariaë* Tamamsch.

29. Prostrate plants, with long, slightly ascending, many-flowered racemes; corolla flash-colored-red or nearly purple; wings white-pink, slightly shorter than corolla 29. *P. transcaucasica* Tamamsch.
 + Erect or ascending plants; corolla variously colored, blue or pinkish; wings oval, much shorter than corolla, 3–5-nerved 30. *P. anatolica* Boiss. et Heldr.

Section 1. MIGRATORIA Tamamsch. — Sect. Orthopolygala, subsect. VI, VIII, Asiaticae Chod. Monogr. (1893) 121, 318. — Style ribbonlike, sometimes filiform, ascending or curved, tapering above and below; stigma inconspicuous, with equal or unequal lobes; filaments connate up to the middle in each bundle; filaments free, sometimes all anthers subsessile (on tube) or 6–8 sessile [on tube].

1. *P. sibirica* L. Sp. pl. ed. 1 (1753) 702; Turcz. Fl. baic.-dah. I, 194; Ldb. Fl. Ross. I, 269 (excl. var. β .); Shmal'g., Fl. I, 119; Kom., Fl. Man'chzh. II, 676; Kryl., Fl. Zap. Sib. VIII, 1855 (excl. var. *angustifolia*); Chodat in Mém. Soc. Phys. de Genève, XXXI, 2, 347, p. p. — Ic.: Ldb. Ic. pl. Fl. Ross. V, tab. 448; Gmelin, Fl. Sib. IV, tab. VII, f. 21–26. — Exs.: G. R. F. No. 307; Herb. Fl. Cauc. No. 382.

Perennial; root straight, woody, branching in upper part and producing numerous stems; stems more or less branching, usually erect, short-appressed-hairy, 10–20 cm high; lower leaves elliptic, short-acuminate or obtuse, the others oval-lanceolate, or lanceolate, up to 3–3.2 cm long, 251 9–10 mm wide, all leaves sparsely short-hairy. Flowering racemes lateral, usually exceeding the leafy apex of stem, loose, one-sided, 2–7 cm long; flowers 3–6 mm long, the lower drooping, pubescent; bracts small, ca. 2 mm long, 0.75–1 mm wide, green; wings (inner sepals) large, 6–7.5 mm long, ca. 3 mm wide, tapering at base to short claw, greenish with broad white edge; corolla pale violet or bluish, shortly and finely pubescent at the inner side; lateral petals 5–6 mm long, shorter than the lower, with finely long-fimbriate keel on top; capsules globular-obcordate, ca. 5 mm in diameter, with inconspicuous depression at apex, marginate with narrow short-ciliate wings. May–July.

Limestones, dry stony cliffs, dry meadows with consolidated sandy or sandy-stony soil, clayey outcrops. — European part: U. Dns., M. Dnp., Bl., V.-Don, Transv., V.-Kama; Caucasus: Cisc., Dag., E. Transc.; W. Siberia: Irt., Alt.; E. Siberia: Ang.-Say., Dau.; Far East: Ze.-Bu., Uss. Gen. distr.: Jap.-Ch., Mong., Ind.-Him., Centr. Eur. Described from "Siberia." Type in London.

Var. *hakobii* Tamamsch. in Fedde, Repert. XXXIX (1936) 321. — Filaments of all stamens connate nearly up to top, or on the same specimen filaments of the two median stamens connate for more than half, the remaining 6 free. — Dagestan, Gunib.

Note. This variety differs from *P. sibirica* also by the ribbonlike style which is straight below and horizontally curved above the middle, as well as by the capsule densely ciliate at margin. These plants should represent a separate species *P. hakobii* Tamamsch.; the type of this species are the specimens collected by Grossgeim on 14 June 1915 in Gunib.

Var. *ciliata* Tamamsch. l. c. — Capsule subglobular, margins with narrow, ciliate wings. Dagestan, Avar Koisuy, Gimri, stony slopes.

2. *P. tenuifolia* Willd. Sp. pl. III (1800) 879; Turcz. Fl. baic.-dah. I, 194; Kom., Fl. Man'chzh. II, 679. — *P. sibirica* β . *angustifolia* Ldb. Fl. Ross. I (1842) 269; Kryl., Fl. Zap. Sib. VIII, 1856. — *P. sibirica* var. *tenuifolia* Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) 348. — Ic.: Kom., and Al., Opr. II, tab. 24, f. 3; Yabe, Ic. Fl. Mansh. I, pt. 1, tab. 6 (1914).

252 Perennial; root oblique, producing numerous stems; stems thin, glabrous, rarely sparsely verrucose, 23–25 cm high; leaves ascending, narrowly linear, (1.5)2–3 cm long, 0.5–1(1.25) mm wide, acuminate, sparingly pubescent. Racemes lateral, exceeding the leafy branches, loose, few-flowered; pedicels ascending, drooping in fruit, arcuately elongating to 6–7 mm; bracts very small, ca. 1 mm long, subulate, mucronate; outer sepals glabrous or hardly verrucose, narrow, linear-lanceolate, 2 mm long, the two inner sepals (wings) large, 5 mm long, 2 mm wide, dorsally striate with broad green lines, pinkish-violet at margin; corolla as in *P. sibirica*; capsules 4–5 mm in diameter, globular-obcordate, with broad depression at apex, and very narrowly marginate with glabrous wings. May–July (August).

Stony mountain slopes, dry sandy meadows; isolated. — W. Siberia: Alt.; E. Siberia: Ang.-Say., Dau.; Far East: Ze.-Bu., Uss. Gen. distr.: Mong., Jap.-Ch. Described from "Siberia." Type in Berlin.

3. *P. japonica* Houttuyn, Handl. Pl. et Krui'k. X, tab. 62, f. 1 (1779); Chodat in Mém. Soc. Phys. de Genève, XXXI, 2, 353; Kom., Fl. Man'chzh. II, 675. — *P. Sieboldiana* Miq. Verb. Acad. Welensh. 2, Vol. II (1868) 85. — Ic.: Chodat, l. c. tab. XXXVIII, f. 18–20; Kom. and Al., Opr. II, tab. 211, f. 2.

Perennial; root woody, crowned by many stems; stems ascending, rarely erect, simple, appressed-hairy, 7–30 cm high, ca. 1 mm thick; leaves elliptic-ovate or elliptic-lanceolate, 0.8–2.5 cm long, 0.45–1.5 cm wide, obtusely acuminate, thin-coriaceous, with margins slightly rolled, bright green above, paler beneath, subglabrous or very sparingly pubescent (mostly beneath along nerves), subsessile, with petiole 1 mm or shorter. Racemes lateral, much shorter than stems; flowers 5–10, remote; bracts very small, ca. 1 mm long, shorter than the pubescent 3–5 mm long pedicels; outer sepals linear-lanceolate, green, white-margined, inner sepals (wings) obovate, violet-pinkish or pinkish, obtuse, up to 8 mm long, 5 mm wide; keel barbate; capsules subglobular or obcordate, incised above, broadly winged, 7 mm wide, glabrous or subglabrous. May–July.

Dry herbaceous slopes of stony soil. — Far East: Uss. Gen. distr.: Jap.-Ch. Described from China.

Section 2. POLYGALON DC Prodr. I (1824) 324. — Sect. *Eupolygala* Bennet. in Journ. of Bot. XVI (1878) 243. — Sect. *Orthopolygala*, subsect. XIV, Chod. Monogr. (1893) 122, 430. — Style straight; stigma conspicuous, 2-lobed, upper lobe erect, concave and spoon-shaped, acuminate, hairy above, sometimes pectinate, lower lobe curved forming a short horizontal lip; filaments connate; anthers distinctly sessile on tube, rarely subsessile.

Subsection 1. POLYGALASTRUM Tamamsch. — Papilionacea
253 Chod. Monogr. (1893) 430. — Anthers of median stamens pubescent, elevated above others; lower petal (with crest) as long as or slightly shorter than upper petals; wing nerves never anastomosing.

4. *P. papilionacea* Boiss. Diagn. ser. I, 1 (1842) 8; Fl. or. I, 475; Chodat in Mém. Soc. Phys. de Genève, XXXI, 2, 478. — Ic.: Chodat, l. c. tab. XXXIV, f. 56–63. — Exs.: Herb. Fl. Cauc. No. 133.

Perennial; root very thick (6–14 mm), woody; stem much branching, lignified, developing numerous appressed-hairy shoots; leaves many, the lower broader, the upper narrowly elliptic or often lanceolate-linear, acuminate, grayish-hairy, 1–2.5 cm long, 0.2–0.5 cm wide. Racemes loose, terminal; bracts slightly longer or as long as pedicels; bracteoles smaller, membranous, more or less violet; deciduous; pedicels up to 2 mm long but usually shorter, covered with curly hairs, later drooping; flowers up to 9–10 mm long, violet or pink-violet; 3 unequal outer sepals glabrous at margin (the upper larger, oblong, 3-nerved), wings (inner sepals) nearly twice as long, 8.5–9 mm long, 5–5.5 mm wide, elliptic, rounded at apex, glabrous; keel very long-fimbriate, tapering and clawlike at base; capsules obcordate, broad, with broad marginal wings not reaching base. May–June.

Rubbly taluses. Known from Kars district and, possibly, might be found in the southern part of Transcaucasia. Gen. distr.: Arm.-Kurd. Described from Turkish Armenia. Type in Geneva.

5. *P. hohenackeriana* Fisch. et Mey. Ind. sem. h. Petrop. IV (1837) 42; Ldb. Fl. Ross. I, 269; Boiss. Fl. or. I, 472 (excl. var. γ .); Chodat in Mém. Soc. Phys. de Genève, XXXI, 2, 477. — Ic.: Chodat, l. c. tab. XXXIV, f. 46–55.

Perennial; root thick, simple, flexuose; stem branching, woody, developing many low (2.5–11 cm high) shoots, densely leafy and (like leaves) densely appressed-hairy; leaves small (up to 2 cm long, 4.5 mm wide), the lower ovate or elliptic, usually ca. 3–5 mm long, obtuse, thick, the upper larger, oblong-lanceolate, acute, grayish-green. Flowers in axillary racemes, whitish-bluish or pale pink; bracts small, as long as pedicels, deciduous; pedicels pubescent, very short (up to 2 mm long), not elongating in fruit; upper outer sepal larger, 5 mm long, oval, the lower two outer sepals smaller, 2 mm long, obtuse, inner sepals (wings) asymmetrical, elliptic-ovate or nearly elliptic, obtuse, 6 mm long, 3 mm wide, whitish with greenish
254 nerves; corolla pale bluish-lilac; capsules 5–6 mm long, obcordate, broadly incised at apex, narrowly winged at margin, 0.5–0.75 mm wide. April–May.

Stony mountain slopes. — Caucasus: E. and S. Transc. Gen. distr.: Iran. Description based on Hohenacker's collections from the vicinity of Kirovabad. Type in Leningrad.

6. *P. stocksiana* Boiss. Diagn. ser. II, 1 (1853) 59. — *P. Hohenackeriana* var. *Stocksiana* Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) 478. — Ic.: Chodat, l. c. tab. XXXIV, f. 54–55.

Perennial; small plants, up to 14 cm high; stems branching, densely pubescent; leaves densely pubescent, linear-lanceolate or lanceolate, acuminate, the upper up to 2 cm long, 4.5 mm wide. Racemes axillary or

terminal, rather loose; pedicels very short (less than 2 mm long), not elongating in fruit; bracts and bracteoles very small, white, membranous; flowers whitish-blue or with faint lilac tinge; the upper outer sepal elliptic, obtuse, 6 mm long, dorsally greenish-violet, lilac or white-scarious at margins, twice as long as the two lower, inner sepals ovate-elliptic, asymmetrical, clawless, 8–9 mm long, ca. 5 mm wide, with free nerves, obtuse; capsules 6.5 mm in diameter, sessile, obcordate, broadly incised above, with equal broad marginal wings, 1–1.5 mm wide. May–August.

Stony slopes. Possibly occurring in the southern part of Transcaucasia since it is known from Kars district (Kagizman). **Gen. distr.:** Arm.-Kurd., Iran. Described from Baluchistan. Type in Geneva.

Subsection 2. **POLYGALELLA** Tamamsch. – Anthers more or less stipitate; upper petals shorter than the crested petal, wings hardly netted-veined.

7. *P. supina* Schreb. Ic. et descr. pl. decad. (1776) 19, tab. V. – *P. Gundelsheimeri* C. Koch in Linn. XIX (1846) 59. – *P. supina* ssp. *pseudohospita* Tamamsch. in schedis. – Ic.: Schreber, l. c.

Perennial; root vertical, flexuose, thin; stems numerous, prostrate or ascending, ca. 10–12 cm long, rather sparsely short-hairy, densely leafy; leaves broadly elliptic-ovate, ovate or elliptic, the lowermost sub-orbicular but small and obtuse, the upper slightly attenuate above, acuminate or obtusely acuminate, 7–18 mm long, 3.5–9 mm wide, sparsely pubescent. Racemes loose, short; bracts and bracteoles membranous, one-third to one-half as long as pedicels; pedicels up to 3–4 mm long, more or less arcuate; flowers pale blue or lilac-pink; the upper outer sepal 255 large and convex at base (as if gibbous), 4 mm long; inner sepals (wings) broadly or narrowly ovate, obtuse, asymmetrical, and tapering and claw-like at base, partly netted-veined, 8 mm long, 3–5 mm wide; capsules globular-obcordate, tapering at base to short stipe, very narrowly incised at apex, with unequal rather broad marginal wings (asymmetrical), 6–7 mm long (with stipe), 4–4.5 mm wide. May–June.

Stony mountain slopes. This species may occur in the southern part of W. Transcaucasia since it is known from Lazistan and Artvin district. **Gen. distr.:** The southern shore of the Black Sea from where it was described.

Note. It is not likely that the Balkanian *P. hospita* Heuff. is different from *P. supina* Schreb.

8. *P. andrachnoides* Willd. Sp. pl. III (1800) 875, p. pte. (excl. syn.). – *P. supina* Ldb. Fl. Ross. I (1842) 270, non Schreb. – *P. supina* var. *andrachnoides* Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) 482. – Ic.: Regel in Bull. Soc. Nat. Mosc. XXXIV, 2 (1861) tab. VII, f. 14–17. – Exs.: A. Callier, Iter Taur. tert. an. 1900, No. 548.

Perennial; root thick; stems numerous, prostrate, branching, 4–20 cm long, rather sparsely pubescent and densely leafy; leaves elliptic-obcordate or orbicular-obovate, rounded-obtuse at apex, tapering to short petiolule,

sparsely pubescent, (2)4–11 mm long, (1.5)2–5.5 mm wide. Racemes short, rather loose; bracts ovate, membranous, one-fourth to one-third as long as pedicels, pedicels 3 mm long; flowers blue; the upper outer sepal larger, ca. 2.75 mm long, concave at base, inner sepals 4.5–5.5 mm long, 2.5–3.5 mm wide, elliptic, ovate-elliptic or oblong-elliptic, usually obtuse, asymmetrical at base, tapering to short claw (their length is shown together with claw), more or less netted-veined; capsules small, asymmetrical, 4 mm long, 2.75 mm wide, oblong-obcordate, with small incision at apex, tapering at base to short stipe, marginal wings slightly developed, nearly inconspicuous. May–June.

Mountain meadows with stony soil, forests of *Quercus* on mountain slopes. — European part: Crim.; Caucasus: E. and S. Transc. Gen. distr.: Arm.-Kurd., As. Min. Described from the Crimea. Type in Berlin.

Note. This species has been erroneously determined by some Russian botanists as *Polygala supina* Schreb.

9. *P. pseudohospita* Tamamsch. — *P. supina* var. *pseudohospita* Tamamsch. in Fedde Repert. XXXIX (1936) 329.

256 Perennial; stems ascending or erect; leaves broadly elliptic to obovate, up to 2–3 cm long, up to 8 mm wide. Racemes few-flowered; lobes of aril of seeds broadly ovate, very short, subequal, up to one-fifth the entire length of the seed.

Caucasus: S. and E. Transc. Gen. distr.: As.-Min. (Artvin). Description based on Zedelmeier's specimens from Nor-Bayazet. Type in Erivan.

Note. This taxon resembles in habit the rather widespread (in Bosnia) *P. supina* var. *hospita*, but distinguished by shape and size of the aril lobes.

10. *P. pruinosa* Boiss. Diagn. ser. I, 1 (1842) 8, p. p.; emend. in Diagn. ser. II, 1 (1853) 58; Fl. or. I, 472. — *P. nicaeensis* Grossh., Fl. Kavk. III (1932) 23, non Risso. — Ic.: Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) tab. XXXI, f. 33–41. — Exs.: Bornmüller, Pl. exs. Anat. or. No. 181 (1889) et 2727 (1890).

Perennial; root thick, woody; stems many, the annotinous curved at base, ascending, covered with soft short hairs, 10–30 cm high; lower leaves obovate-cuneate, generally 6–15 mm long and 2.5–4 mm wide, obtuse, upper leaves longer, linear-spatulate, up to 2.5 cm long. Flowering racemes loose, much elongating post anthesis; bracts filiform-linear, acuminate, usually longer than pedicels, lateral bracteoles smaller; pedicels elongating up to 3–3.5 mm, drooping but usually not arcuate; outer sepals elliptic or narrowly elliptic, mucronate, pubescent, 3–4 mm long, inner sepals elliptic, 8–10 mm long, 4.5 mm wide, somewhat asymmetrical, slightly acuminate, tapering at base to obscure claw, whitish-lilac; corolla pink-asymmetrical (with unequal asymmetrical broad marginal wings), obcordate, tapering at base to a stipe, with narrow incision at apex. May–July.

Stony mountain slopes. — Caucasus: W. and S. Transc. Gen. distr.: Arm.-Kurd., As. Min. Described from As. Min. Type in Geneva.

Subsection 3. EUPOLYGALON Tamamsch. — *Vulgares* Chod.
Monogr. (1893) 430. — All anthers equal, glabrous; upper petals longer than the lower crested petal, wings always distinctly or weakly netted-veined.

11. *P. austriaca* Crantz, Stirp. Austr. ed. 2, II (1769) 439. —
P. amara γ. *austriaca* Lam. ex DC. Fl. France, II (1805) 456. —
P. decipiens Bess. Enum. pl. Volhyn. (1822) 73. — *P. amara*
subsp. *amarella* var. *austriaca* Chodat in Bull. Soc. Bot. Genève,
V (1889) 161. — Ic.: Crantz, l. c. tab. II; Rchb. Ic. Fl. Germ. XVIII,
tab. 1348.

257 Perennial; plant loosely caespitose with stems 15–25 cm high; leaves of rosettes pubescent at base, likewise the cauline leaves obtuse and linear or acuminate. Inflorescence short, dense, later elongating; sepals short, with rather broad median stripes thus appearing green; wings with sharp green median nerve and sharp lateral nerves, usually bluish-white, in fruiting 2.5–3.5 mm long, 1–1.5 mm wide, rarely up to 5 mm long and 2 mm wide; capsules 3–4 mm long, 2.5–3 mm wide. June–July.

Stony slopes. — European part: U. Dns. (Transcarpathian Region).
Gen. distr.: Centr. Eur. Described from Austria. Type in Vienna.

12. *P. subamara* Fritsch in Mitt. nat. Ver. Steierm. (1908) 202. —
P. amara subvar. *brachyptera* Chod. Monogr. II (1893) 417. —
P. amara ssp. *brachyptera* Hayek, Sched. Fl. Stir. 9–10 (1906)
21. — *P. brachyptera* Szaf., Kulcz., Pavl. Rosl. Polskie (1924) 326,
non Griseb. —

Perennial; plants densely caespitose; stems 5–20 cm high; cauline leaves lanceolate-spatulate, rosetted leaves ovate, abruptly cuneate-tapering at base, twice as broad and nearly twice as long as the upper lanceolate leaves. Flowering racemes many-flowered; flowers pale violet or white; wings lanceolate, twice as long as capsule; keel with fimbriate appendage. June–July.

Limestone slopes. — European part: U. Dns. (Chivchinskie Mountains).
Gen. distr.: Centr. Eur. Described from Styria. Type in Vienna.

Note. It is quite possible that the population of the Eastern Carpathians is a separate race named by Wołoszczak as "var. *carpatica* Wol."

13. *P. amarella* Crantz, Stirp. austr. fasc. V (1769) 438; Kryl., Fl. Zap. Sib. VIII, 1858; Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) 471, non Rchb. — *P. amara* Ldb. Fl. Ross. I (1842) 272; Shmal'g., Fl. I, 120, non Jacq. — *P. amara* ssp. *amarella* Chodat in Bull. Soc. Bot. Genève, No. 5 (1889) 160. — Ic.: Chodat, Monogr. tab. XXXIV, f. 26–33. — Exs.: G. R. F. No. 655.

Perennial; root thin; stems 5–15 cm high, few, subglabrous, simple, rarely branching; lower leaves in basal rosettes, larger, 1–2.5 cm long, 4–10 mm wide, obovate, rounded-obtuse at apex; cauline leaves narrower and small, 1–2 cm long, 1.5–5(7) mm wide, oblong or lanceolate, short-acuminate, cuneate-tapering towards base. Flowering racemes pyramidal when young, later elongating, cylindrical, not dense, 1.5–7 cm long; pedicels short, 1–2 mm long; middle bracts ca. 1.5 mm long, lateral bracteoles 0.75–1 mm long, all early deciduous, oblong, short-acuminate; flowers blue,

258 rarely pale blue or white, small; 3 outer sepals 2–2.5 mm long, 0.75–1 mm wide, oblong or oblong-elliptic, obtuse; wings (inner sepals) elliptic, obtuse or short-acuminate, 3.5–4 mm long, 2.5 mm wide; corolla nearly as long as wings; lateral petals nearly as long as the fimbriate keel; ovary sessile; capsules small, obcordate, 4 mm long, 3.5 mm wide, glabrous; seeds ovate, with short aril. June.

Damp and swampy meadows. — European part: Kar.-Lap., Dv.-Pech., Lad.-Ilm., U.V., V.-Kama, V.-Don, U.Dnp., M.Dnp., Bl. Gen. distr.: N. and Centr. Eur. Described from Lower Austria.

Economic importance. The plant is used, though very rarely, in medicine. Aqueous solutions that are prescribed for strengthening activity of the stomach and as expectorants during bronchitis are made of all parts of this plant (*Herba Polygalae amarae cum radice*).

Note. There is only one specimen of this plant from the Caucasus, collected by Lagovskii, which obviously originated in another locality.

14. *P. suanica* S. Tamamsch. in Fedde Repert. XXXIX (1936) 328.

Perennial; small plants; stems short, thin. Flowers very small, on short pedicels; bracts slightly larger than bracteoles; wings obovate or orbicular-ovate, ciliate above, 3–5-nerved, nerves hardly anastomosing; petals hardly longer than wings, pinkish, tube shorter than limb, very distinctly twisted; keel as long as tube; lateral petals longer than tube, broadly ovate below.

Caucasus; E. Transc. Endemic. Description based on Radde's specimen from Svanetia. Type in Tbilisi.

15. *P. alpicola* Rupr. Fl. Cauc. (1869) 166. — *P. amara* β . *alpestris* Ldb. Fl. Ross. I (1842) 272. — *P. alpestris* Boiss. Fl. or. I (1867) 476, p. p. non Rchb. — *P. microcarpa* Chodat in Mém. Soc. Phys. de Genève, XXXI, 2 (1893) 474, p. p. (quoad plantam cauc.) non Gaud. — *P. amara* var. *minor* Trautv. in herb. p. p. — Exs.: Pl. or. exs. No. 161.

259 Perennial; root thin, producing few sterile densely leafy shoots and floriferous stems; stems more or less curved at base, subglabrous; inner leaves small, upper leaves gradually larger, lanceolate or broadly lanceolate, sometimes ovate-lanceolate, acuminate, obtuse, up to 2–2.5 cm long, 5–5.5 mm wide. Racemes dense (even after blossoming), rather many-flowered, short, slightly elongating after blossoming; bracts small, almost as long as or shorter than pedicels, soon deciduous, elliptic; pedicels about 1–2 mm long, later curved; the three outer sepals subequal, 2 mm long, elliptic-lanceolate, inner sepals (wings) 4–5 mm long, 2–3 mm wide, obovate or oblong-obovate, obtuse, clawless, abruptly tapering at base, nerves not or hardly anastomosing; flowers bright blue; capsules obcordate-ovate, 4.5 mm long, 3.5 mm wide, incised at apex, narrowly winged at margin, sessile. June–July.

Subalpine meadows. — Caucasus: Cisc., Dag., W., E. and S. Transc. **Gen. distr.:** Arm.-Kurd. Described from the Main Range of the Caucasus. Type in Leningrad.

16. *P. caucasica* Rupr. Fl. Cauc. I (1869) 165; Tamamsch. in Fedde Repert. XXXIX, 327.

Perennial; stems erect or ascending, subglabrous, thin; leaves sessile, varying in size, lanceolate. Inflorescence short, slightly elongating in fruit; bracts soon deciduous hence not forming a top on inflorescence; flowers small, pale pink or blue, sometimes whitish; corolla hardly or not protruding from wings; ovary on very short stipe; capsules sessile or obsoletely stiped, narrowly winged, symmetrical; seeds oblong; lobes of aril short, broad.

Up to subalpine meadows. — Caucasus: Cisc., Dag., E. Transc.

Endemic. Described from Dagestan. Type in Leningrad.

Var. *zangesura* Tamamsch. l. c. — Stems low, up to 20–30 cm, sparingly pubescent; leaves small, pubescent, the lower obovate; cauline leaves lanceolate, 1–1.5 cm long, 3–4 mm wide; the upper narrower. Flowers violet-pink; pedicels downcurved post anthesis; median [outer?] sepals longer than the others; wings oval, acuminate, 3-nerved; corolla tube as long as limb; ovary as long as its stipe; style slightly bent at base; capsules narrower than wings, with broad edge.

Mountainous meadows. S. Transc. (Zangezur). Type in herbarium of the Armenian Academy of Sciences.

Var. *abchasica* Tamamsch. l. c. — Corolla slightly longer than wings; wings oblong-ovate at anthesis, ciliate at margin; capsules as wide as or slightly wider than wings. Abkhazia.

Var. *alpigena* S. Tamamsch. l. c. — Small alpine plants; stems appressed to ground; wings orbicular-oval; flowers pink. In the upper mountain zone of C. Caucasus.

17. *P. vulgaris* L. Sp. pl. ed. 1 (1753) 702; Ldb. Fl. Ross. I, 270; p. p.; Shmal'g., Fl. I (1895) 120; Chodat in Mém. Soc. Phys. Genève, XXXI, 2 (1893) 448, p. p. — Ic.: Stephan, Ic. Pl. Mosq. tab. 14 (1795); Maevskii, Fl. Sr. Ross. ed. 5 (1918) 79. — Exs.: G. R. F. No. 357.

260 Perennial; root thin; stems many, ascending or prostrate at base, densely leafy, subglabrous, simple or branching; lower leaves broader and shorter than the rest, elliptic, lanceolate-elliptic or elliptic-obovate, obtusely acuminate, upper leaves linear-lanceolate or lanceolate, acuminate. Racemes terminal, the young pyramidal, rounded at apex, without pappus of protruding bracts, later elongating and rather loose but many-flowered; bracts oval, acute, the middle as long as or nearly as long as pedicels, the lateral much shorter; pedicels ca. 1.75–2 mm long, later arcuately curved; flowers blue; wings elliptic or obovate-elliptic, 6–7 mm long, 3–4 mm wide, obtuse, tapering at base, netted-veined; corolla as long as wings; capsules obcordate, longer than wide, tapering at base but without distinct stipe, 5 mm long, 3.5 mm wide, winged at margin; seeds oblong, brown, hairy; aril 3-lobed. June–July.

Meadows. — European part: Kar.-Lap., Lad.-Ilm., U. V., U. Dnp. Gen. distr.: Scand., Atl. Eur., Centr. Eur. Described from Central Europe. Type in London.

18. *P. hybrida* DC. Prodr. I (1824) 325; Rupr. Fl. Cauc. I, 162. — *P. spuria* Stev. ex Ldb. Fl. Ross. I (1842) 271. — *P. Wolfgangiana* Besser ex Ldb. l. c. — *P. comosa* Ldb. l. c. p. p.; Turcz. Fl. baic.-dah.

I, 195; Kom., Fl. Kavk. II, 297; Kryl., Fl. Zap. Sib. VIII, 1857, non Schkuhr. — *P. comosa* var. *altaica* Chodat. in Mém. Soc. Phys. Genève, XXXI, 2 (1893) 455. — *P. comosa* α. *hybrida* Schmalh., Fl. I (1895).

Perennial; root thick; stems 15–40(50) cm high, numerous, erect or curved below, slightly pubescent or subglabrous; leaves coriaceous, thick, slightly inrolled at margin, upper leaves oblong-lanceolate to linear, lower leaves smaller and wider, lanceolate or obovate-lanceolate. Racemes dense, the young with apical pappus of protruding bracts; middle bracts longer than or as long as pedicels, lateral bracteoles as long as or shorter than pedicels, wide, lanceolate, acuminate; pedicels up to 3 mm long, later curved; flowers pale blue, rarely pink-lilac or even whitish, with faint purple tinge; wings 6–9 mm long, 4–5 mm wide, ovate or elliptic, netted-veined, obtuse or obtusely acuminate; corolla almost as long as wings; capsules oblong-obcordate, 5 mm long, 4 mm wide, on short stipes ca. 0.75 mm long, with shallow incision above, winged at margin, glabrous; seeds cylindrical-ellipsoid, pubescent; aril barbed at apex. June–August.

Steppical meadows, pine forests, limestones, chalky slopes, stony mountain slopes. — European part: V.-Kama, Transv.?, V.-Don, M. Dnp.; 261 W. Siberia: U. Tob., Ob, Irt., Alt.; E. Siberia: Ang.-Say., Dau., Lena-Kol.; Centr. Asia: Dzu-Tarb., T. Sh., Pam.-Al. Gen. distr.: Dzu.-Kash., Mong. Described from "Ural deserts." Type in Geneva.

19. *P. comosa* Schkuhr, Bot. Handb. II, p. 324, tab. 194 (1796); Ldb. Fl. Ross. I, 271, p. p.; Shmal'g., Fl. I, 120 (excl. ssp. α.). — *P. vulgaris* ssp. *comosa* Chodat in Mém. Soc. Phys. Genève, XXXI, 2 (1893) 453, pro min. pte. — Ic.: Schkuhr, l. c.; Rchb. Ic. pl. crit. tab. XXVI, f. 54–56 (1823). — Exs.: G. R. F. No. 254.

Perennial; root thin; stems many, ascending at base, (10)15–25 cm high, simple, subglabrous; leaves linear-lanceolate, many, up to 3–3.5 mm long, 4–5 mm wide, obtusely acuminate. Flowering racemes dense, with pappus of bracts at apex; rachis short-hairy and angular; flowers purple-violet (very rarely whitish); bracts caducous, linear, acuminate, membranous; pedicels very short, ca. 1–1.75 mm long, later arcuately curved; outer sepals elliptic-lanceolate, obtuse, 2–3 mm long; wings elliptic, obtuse, abruptly tapering at base, 5–6 mm long, 2.5–3.5 mm wide, inconspicuously netted-veined; corolla about as long as wings; capsules sessile, tapering at base, obovate or obovate-cordate, narrowly winged at margins, narrowly incised above, glabrous, small, 4–4.5 mm long, 2.5–2.75 mm wide. (May) June (July).

Meadows (in dry valleys), shrubby thickets, forest glades. — European part: Kar.-Lap., Dv.-Pech., Lad.-Ilm., U. V., V.-Kama, V.-Don, U. Dnp., M. Dnp., Bl., Crim.; Caucasus: Cisc., W. Transc. Gen. distr.: Centr. Eur., Scand. Described from the vicinity of Leipzig.

Note. *P. pinetorum* Alech., described by Alekhin (Predv. otch. Nizheg. eksp. 1928 g., IV, 1929, 92), should perhaps be referred to as *P. comosa* s. l. It is quite possible that *P. podolica* DC. (Prodr. I, 1824, 325) and *P. wolfgangiana* Bess. (nom. nud. ex Ldb. Fl. Ross. I, 271) represent a separate race of the sandy pine forests stretching from Podolia to the central Volga area.

20. *P. moldavica* Kotov in Botanichn. Zhurn. I, 2 (1940) 277. — *P. major* auct. non Jacq.

Perennial; stems 25–50 cm high, branching; lower leaves oblong, small; cauline leaves linear-lanceolate. Bracts longer than flower buds and form a pappus at top of racemes; wings oblong-elliptic, with 3 nerves united at apex by oblique-transverse nerve; corolla pale purple, 11–15 mm long; ovary on stipe two to three times as long as ovary at anthesis; style four times as long as ovary. May–July.

262 Limestones. — European part: Bl., Bes. (along Dniester). Endemic. Described from the vicinity of Tiraspol. Type in Kiev.

21. *P. amoenissima* Tamamsch. in Fedde Repert. XXXIX (1936) 324.

Perennial; stems many, thick, ascending, densely leafy, up to 60 cm high; lower leaves sessile, elliptic, obtuse, upper leaves oblong, tapering but not acuminate. Racemes long, terminal, dense; bracts and bracteoles colored, caducous, membranous, ciliate at margin; bracts twice as long as bracteoles; pedicels twisted, drooping post anthesis; wings and corolla pale lilac; sepals also colored, linear-lanceolate, the median longer than the other two; wings oblong-ovate, becoming pale post anthesis, obtuse, 5–7-nerved, the main rib and the two median thick, branching above, the two lateral and the two marginal curved, much branching; corolla tube nearly twice as long as limb; ovary one-fourth as long as its stipe; capsules as long as stipe, broadly ovate-cordate, as wide as wing; seeds ovate, appressed-hairy; lobes of aril short, lateral lobes slightly longer than the median.

Caucasus: possibly occurring in W. Transc. Gen. distr.: As. Min., Turkey. Description based on Voronov's specimens from Artvin (Dzhamal). Type in Tbilisi.

22. *P. cretacea* Kotov in Zhurn. Inst. Botan. AN UkrSSR. 21–22 (29–30) (1939) 238. — *P. hybridum* auct. non DC. — *P. major* auct. non Jacq.

Perennial; stems 30–40 cm high, branching. Corolla 10–12 mm long, pale purple, slightly longer than wings, with tube about as long as lateral pteroid petals; ovary long stipitate, nearly $1\frac{1}{2}$ times as long as stipe. Fl. June–July.

On chalky outcrops in the basin of the Donets River. — European part: V.-Don (S.). L. Don. Endemic. Described from chalks along the Oskol River. Type in Kiev.

23. *P. major* Jacq. Fl. austr. II (1778) 6, tab. 413; Ldb. Fl. Ross. I, 270; Boiss. Fl. or. I, 474; Shmal'g., Fl. I, 119. — *P. magna* Georgi ex Ldb. Fl. Ross. I (1842) 270. — Ic.: Rchb. Pl. crit. I, tab. 27; Fl. Germ. XVIII, tab. 1350; Taliev in Tr. Obshch. Est. Khar'k. un. XXX, p. 2. — Exs.: Fl. exs. austro-hung. No. 3641.

263 Perennial; stems numerous, virgate, ascending, long, simple or branching, sparingly pubescent, densely leafy, up to 40–50 cm high; lower leaves oblong, obtuse, upper leaves broad and long, sessile, lanceolate. Racemes conoidal, many-flowered; flowers up to 15–16 mm long; wings oblong or elliptic, 3–5-nerved, nerves netted in between; corolla longer than wings,

pink or becoming pale, tube twisted, ascending, longer than wings; ovary on a two to three times longer stipe; capsules shorter than wings, narrower, stipitate; seeds ovate; median lobe of aril appressed to seed, lateral lobes longer.

European part: U.Dns., M.Dns., Bl., Crim. Gen. distr.: Centr.Eur. Described from Austria. Type in Vienna.

Var. *alata* Tamamsch. in Fedde Repert. XXXIX (1936) 324. — Capsules broadly ovate, broadly winged; wings of capsule as wide above as valves, much nerved. — Caucasus: Cisc. (Kuban, Teberda).

24. *P. colchica* Tamamsch. sp. n. in Addenda XIII, 733.

Perennial; small plants; stems many, slightly woody at base, with short internodes, up to 15–18 cm high, sometimes up to 25 cm, subglabrous; leaves small, densely disposed, narrow, lower leaves lanceolate, acuminate, upper leaves linear, up to 1.5–2 cm long. Racemes up to 5–7 cm long, loose; flowers rather large; median sepals longer than the two lateral; wings elliptic, distinctly tapering below, slightly acuminate above, sometimes ciliate, with 3 thin nerves slightly anastomosing; corolla tube narrow, strongly curved, as long as or sometimes slightly longer than wings; ovary stipitate, stipe nearly twice as long as ovary; capsules pedicel with a rather wide margin; seeds oblong; lobes of aril short, subequal.

Herbaceous slopes. — Caucasus: W. Transc. Endemic. Description based on Voronov's specimens from Abkhazia, near Tsebel'da. Type in Tbilisi.

Note. Specimens collected by Voronov on hilly slopes near Tandor in the former Artvin district are included in this species.

25. *P. mariamae* Tamamsch. in Fedde Repert. XXXIX (1936) 325.

Perennial; multicaulescent erect plants. Racemes short, many-flowered; flowers mostly white, sometimes pinkish or blue; wings elliptic, acuminate, with 5 nerves much branching and anastomosing; corolla as long as or slightly longer than wings, limb nearly as long as tube or slightly shorter, tube curved, ascending; crest of keel lobate with wide obtuse lobes; ovary and fruit long-stipitate, stipe not longer than fruit; seeds oblong-ovate; lobes of aril equal.

264 Caucasus: E. Transc. Endemic. Description based on Kozlovskii's specimens from Georgia (Ak-Bulak). Type in Tbilisi.

Note. This species is intermediate between *P. anatolica* Boiss. and *P. major* Jacq., differing from the two by the ovate shape of its seeds which somewhat resemble those of *P. sibirica* L.

26. *P. leucothyrsa* Voron. in Voron. et Schelk. in sched. ad Herb. Fl. Cauc. f. V–VIII (1916) 86; Grossg., Fl. Kavk. III, 22. — Exs.: Herb. Fl. Cauc. No. 381.

Perennial; stems 40–50 cm high, branching, entire plant sparingly pubescent; lower leaves obovate, cauline leaves lanceolate, upper leaves lanceolate-linear, obtuse. Racemes long, 40–50-flowered, axillary and terminal; flowers white or pale yellow, often with reddish tinge, 7–8 mm long; inner sepals linear-lanceolate, 3–3.5 mm long; wings nearly as long as or slightly shorter than corolla, asymmetrical, oblong-elliptic in fruit,

cuneate at base, with 5 anastomosing nerves, 7 mm long, 3 mm wide; capsules obcordate, on ca. 1 mm long stipes, up to 4.5–5 mm long, 3.5 mm wide, marginate with narrow, very finely granular edge. Fl. April–May; Fr. May–June.

On mountain slopes. — Caucasus: E. Transc. Endemic. Described from Aresh near Kirovabad. Type in Tbilisi (published).

27. *P. urartu* Tamamsch. in Fedde Repert. XXXIX (1936) 322.

Perennial; stems many, erect, somewhat angular, sparsely hairy, densely leafy, up to 25 cm high; leaves sessile, coriaceous, shiny, when dry slightly rolled at margin, midrib distinctly prominent; lower leaves orbicular, broadly elliptic, the median rhombic, sometimes emarginate at apex, 2–3 cm long, 1 cm wide. Racemes with an apical pappus when young, oblong-oval, very dense throughout; bracts and bracteoles persistent, membranous at margin, ciliate, colored at middle, greenish-blue, bracts twice as long as bracteoles, acuminate, acutely toothed, longer than pedicels; pedicels glabrous or sparingly pubescent, suberect to spreading, blue becoming green; flowers gentian-blue, becoming slightly pinkish when dry; sepals equal, broadly lanceolate, hairy, greenish-blue; wings broadly elliptic, bright blue, obtuse, 8–10 mm long, 3–5-nerved, midrib thick, anastomosing into lateral nerves above, slightly ciliate at upper margin; corolla shorter than or sometimes as long as wings but never longer, tube straight, limb as long as tube, lateral petals longer than crest; ovary stipitate.

Caucasus: S. Transc. Endemic. Described from Garni-arykh Mountain (Arai-ler) near Erivan. Type in Erivan.

265 28. *P. kemulariae* Tamamsch. sp. n. in Addenda XIII, 733.

Perennial; sparingly pubescent plants, woody at base; stems ascending; lower leaves obovate or spatulate, median leaves linear-lanceolate or linear, numerous. Racemes long, with pappus of bracts when young; bracts as long as or longer than pedicels; wings broadly ovate, mucronulate or not, as long as corolla, netted-veined; corolla tube shorter than limb, limb of upper petal wide, exceeding crest; ovary obovate; style twice as long as ovary; capsules obovate, sessile or inconspicuously stipitate, broadly winged, shorter and somewhat narrower than wings of flowers; lobes of aril unequal, the lateral longer than one third of the seed, the dorsal slightly horizontally spreading.

Caucasus: Dag., W. and E. Transc. Endemic. Description based on *Kemularia* specimens from Kutaisi. Type in Tbilisi.

Note. *Kemularia* referred this species to the highly polymorphic, Mediterranean *P. niceaensis* Risso.

29. *P. transcaucasica* Tamamsch. in Fedde Repert. XXXIX (1936) 325. — *P. hybrida* Rupr. Fl. Cauc. (1869) 163, non DC. — *P. anatolica* var. *floribunda* Boiss. Fl. or. I (1867) 474. — *P. major* var. *anatolica* f. *floribunda* Chod. Mon. Polyg. (1893) 438.

Perennial; stems many, glabrous or slightly pubescent, spreading, sometimes ascending only at top; leaves narrow, linear-lanceolate, 1–1.5 cm long. Racemes densely flowered, cylindrical, twice as long as the leafy part of stem; bracts and bracteoles long, not deciduous; sepals equal,

hairy at margin; wings whitish-pink, oblong-ovate, slightly shorter than corolla, becoming green after blossoming, 3–5-nerved, nerves anastomosing, the lateral short, weak; corolla purple- or flesh-pink or peach-colored, tube like in *P. anatolica*, up to 10–12 mm long; ovary on short stipe; capsules oblong-cordate, deeply incised above, broadly winged; seeds oblong, with very short lobed aril.

Caucasus: E. Transc. (N. Armenia, Dzhavakhetia). Endemic. Description based on Shelkovnikov's specimens from N. Armenia, Stepanovan (former Dzhelaloglu). Type in Erivan.

30. *P. anatolica* Boiss. et Heldr. in Boiss. Diagn. ser. 2, f(1853) 57; Boiss. Fl. or. I, 474; Grossg., Fl. Kavk. III, 22. — *P. major* auct. fl. cauc. — *P. major* var. *anatolica* Chodat. Monogr. (1893) 437.

- 266 Perennial; root woody, thick; stems many, ascending, robust, densely leafy, sparsely pubescent, 10–40(50) cm high; lower leaves oblong, obtuse, upper leaves longer, linear-lanceolate or linear, up to 5 cm long, acuminate. Racemes long, terminal, with apical pappus of bracts (subanthesis); bracts caducous, membranous often dorsally colored, lateral bracteoles as long as pedicels or slightly longer, elliptic, acuminate, median bracts twice as long, acuminate; pedicels short, 2–3 mm long, slightly elongating in fruit; flowers pale purple, pinkish (f. *rosea* Woron.), whitish (f. *alba* Woron.) or (rarely) blue; outer sepals lanceolate-linear, ca. 4.5–6 mm long; wings elliptic, usually pinkish, 3-nerved, with greenish midrib, obtuse or obtusely acuminate, 10–11 mm long; corolla distinctly longer than wings, 12 mm long, tube arcuately curved and ascending, usually pink-lilac; ovary stipitate, stipe 3 to 4 times as long as ovary; style filiform, four times longer than ovary; capsules glabrous, ovate-obcordate, on slightly shorter stipes, winged at margin, 4.5 mm wide. May–July.

Limestones, mountainous meadows. — Caucasus: Dag., S. and E. Transc. Gen. distr.: Bal.-As. Min. Described from Anatolia. Type in Geneva.

Family LXXXVI. **EUPHORBIACEAE*** J. ST.-HIL.

- Flowers unisexual in monoecious or dioecious plants, with sepals and petals or apetalous; sepals and petals of staminate and pistillate flowers irregular in shape and size; sepals valvate or imbricate at aestivation; petals free; disk compact, annular or of separate glands, sometimes rudimentary; stamens in staminate flowers as many or twice as many as petals, or many more, sometimes fewer or reduced to 1, filaments free or more or less connate, anthers 2-locular, rudimentary ovary present or absent; pistillate flowers with or without staminodes; ovary usually 3-locular, more rarely 2-locular, rarely 1-locular or multilocular; styles free or more or less connate, usually 2-lobed, rarely with more lobes; ovules 1 or 2 in each cell, collateral, anatropous, drooping, with ventral suture, micropyle sometimes with appendage (also in seeds); fruit usually splitting into 3 cells (not always dehiscent), with persistent central column, sometimes berrylike or drupaceous; seeds as many as ovules, rarely less, with developed endo-
267 sperm; embryo straight or bent, usually with broad cotyledons. Herbs,

* Treatment by A.I. Poyarkova, except for the genera *Euphorbia* and *Ricinus*.

shrubs or trees, diverse in habit, often with milky juice; leaves usually alternate; stipules often present, sometimes reduced into glands; inflorescence usually compound, racemiform or spiciform, rarely simple, few-flowered or flowers crowded in generally cup-shaped bract (envelope) forming a unique inflorescence — cyathium.

Euphorbiaceae comprises more than 270 genera with about 4,500 species distributed throughout the world, but mainly in the tropical countries.

Key to Genera

1. Leaves very large, peltate, digitate with 5–7-lobes; monoecious plants with paniculate inflorescence; flowers apetalous, the staminal with numerous stamens, filaments branching, and anthers free, pistillate flowers with 2-cleft styles, ovary with 1 ovule in each cell; in the USSR tall herbaceous cultivated plants **Ricinus* L.
- + Leaves different, smaller 2.
2. Monoecious trees with large, entire or 3-lobed leaves and large flowers in few-flowered paniculate inflorescences; flowers with numerous stamens disposed in few rows on convex receptacle; fruit 3–5-locular, indehiscent, large, with 1 seed in each cell **Aleurites* Forst.
- + Shrubs with small leaves, flowers and fruits, or small shrubs or herbs 3.
3. Monoecious plants, flowers without perianth; staminate flowers many, with only a single stamen (filament jointed) 1 pistillate flower in the center, all flowers in a calyciform bract forming a flowerlike cyathium; cyathium solitary, axillary or terminal, dichasial, or disposed in umbelliform inflorescence; herbaceous plants with milky juice 856. *Euphorbia* L.
- + Flowers with simple or double perianth, 1–3 or clustered in axil or in racemiform or spiciform inflorescences; plants without milky juice 4.
4. Leaves opposite; dioecious plants; flowers with 3 sepals, apetalous, staminate flowers in glomerules arranged in an interrupted spikelike, inflorescence, pistillate flowers 1–2 in axil of bracts forming a spike or raceme 854. *Mercurialis* L.
- + Leaves alternate 5.
5. Herbs or small semishrubs 8.
- + Shrubs with 1–2 flowers in axil or flowers clustered 6.
6. Monoecious plants, flowers with sepals and petals; stamens 5; staminate flowers 1–3 in axil, pistillate flowers solitary; low shrubs, with thin branches and leaves, 1–3.5 cm long; fruit cells 2-seeded 848. *Arachne* Neck.
- + Dioecious plants, flowers apetalous; staminate flowers 5–20 in cluster, pistillate flowers solitary, rarely 2–3; cells of fruit 1-seeded; taller shrubs, with larger leaves 7.
7. Fruit dry, trihedral, with separating cells; seeds with thin coriaceous testa, without protrusion on ventral side; leaves usually elliptic, with faintly discernible and not protruding nerves; stamens nearly twice as long as calyx 850. *Securinega* Comm.

- + Fruit berrylike; seeds with hard woody testa and protrusion at the ventral side; leaves obovate, with prominent nerves; stamens nearly three times as long as calyx 851. *Flüggea* Willd.
- 8. Stems, leaves and inflorescence densely covered with stellate hairs; flowers in spikes or racemes, staminal flowers in upper part of inflorescence, short-pedicelled, pistillate flowers basal, on longer pedicels; seeds 1 in each cell 853. *Chrozophora* Neck.
- + Plant glabrous or sparsely simple-hairy 9.
- 9. Flowers apetalous, eglandulose, staminate and pistillate flowers in a common inflorescence, the staminate forming thin spike in the upper part of inflorescence, the pistillate in axil of large foliate bracts at base of inflorescence; leaves (1.5)2–7 cm long
- + 855. *Acalypha* L.
- + Flowers with glands and petals or only with glands, 1–3 in axil; leaves 0.2–2.5 mm long 10.
- 10. Annuals, 5–25 cm high; flowers apetalous . . . 852. *Phyllanthus* L.
- + Semishrubs or rarely perennial herbs; 0.2–0.8(1.2) cm long; flowers with petals 849. *Andrachne* L.

Subfamily 1. **PHYLLANTHOIDEAE** Pax in E. u. P. Pflanzenfam. III 5 (1896) 13.— Two ovules in each cell; latex vessels absent.

Tribe 1. **PHYLLANTHEAE** Pax. l. c.— Flowers usually with calyx, staminate flowers in axillary nodular inflorescences; pistillate flowers usually solitary.

Subtribe 1. **ANDRACHNINAE** Pax in E. u. P. Pflanzenfam. III, 5 (1896) 15.— Leaves entire, alternate; flowers monoecious, petalous, staminate flowers usually in axillary few-flowered nodular inflorescences, pistillate flowers usually solitary; disk glands opposite petals; stamens 5, with free or connate filaments; styles bipartite; ovary cells with 2 ovules each.

269 Genus 848. **ARACHNE** * Neck.

Neck. Elench. bot. (1790) 348.— *Hexakistra* Hook. f. Fl. Brit. Ind. V (1887) 283

Flowers unisexual, the staminate flowers with petals and free filaments, the pistillate with very small petals and disk glands, petals usually adnate to disk, rarely free; fruit dry, separating at sutures into three 2-seeded cells; seeds without appendages. Erect shrubs, rarely annual, without milky juice; leaves rather large, with basal stipules.

This genus comprises 15 species; those other than the Russian occur in SE Asia, the islands of the Malay Peninsula and 2 in Australia.

* A mythological name.

1. *A. colchica* (Fisch. et Mey.) Pojark. in Botanich. Zhurn. SSSR. XXV (1940) 342. — *Andrachne colchica* F. et M. in Boiss. Fl. or. IV (1879) 1137; Lipskii, Fl. Kavk. 446; Grossg., Fl. Kavk. III, 25. — Exs.: Herb. Fl. Cauc. No. 478.

Perennial; erect glabrous shrub, up to 60–80 cm high, with thin, pale and densely leafy shoots; stipules ca. 1 mm long, obliquely ovate, acuminate; leaves thin, bright green above, paler beneath, glaucescent, ovate, usually obtuse, rarely acute at apex, rounded at base, (7)10–35 mm long, (4)6–20 mm wide, petioles 2–2.5 mm long. Pedicels very long and thin; staminate flowers sometimes 2–3, pale green at first, later yellowing, with ovate sepals connate for one-third to one-fourth, sparsely ciliate at margin, with petals cuneately tapering to claw, two-thirds as long as sepals and deeply parted [?] into narrow obtuse lobes by the disk glands; pistillate flowers always solitary, with ovate petals and glands, adnate below to an uninterrupted 10-lobed disk; ovary glabrous, styles connate at base; fruit flattened-globose, 3-locular, with 2 seeds in each cell; seeds trihedral. Fl. end of May–June, Fr. from July. (Plate XV, Figure 1.)

Stony limestone slopes. — Caucasus: W. Transc. Endemic. Described from Imeretia. Type in Geneva.

Economic importance. Sometimes grown in dendrological gardens. An exquisite ornamental shrub which should be cultivated in the southern and western regions of the USSR.

Genus 849. **ANDRACHNE** * L.

L. Sp. pl. ed. 1 (1753) 1014

270 Flowers solitary in monoecious plants; calyx deeply 5-partite; disk composed of 5 2-lobed or 2-partite glands; staminate flowers with developed petals and 5 stamens, filaments long- or short-connate into a column; pistillate flowers with very small, reduced petals and 3-locular ovary with 2 ovules in each cell; fruit dry, separating at sutures into 3 cells; seeds without appendages. Semishrubs or rarely perennial herbs, without milky juice; stipules white, peltate, leaves small.

Twenty-two species, mostly found in Iran and Central Asia. The genus is spread throughout the Mediterranean area up to Morocco and occurs also in Ethiopia, Somalia and the Cape Verde Islands. One species is known from Cuba and Peru. *Andrachne* includes the sections *Telephioides* Endl., *Fruticulosae* Pax et K. Hoffm. and *Phyllanthidia* Müll. Arg. (the latter is not present in the USSR).

1. Seeds oblong, 2.5–3 times as long as broad; usually small plants 3–15 cm high, with habit of semishrub 2.
- + Seeds broad, suborbicular; usually larger plants 20–90 cm high, herbaceous, or semishrubs but sometimes not obviously so 7.

* Ancient name for *Portulaca oleracea* L. whose leaves resemble those of the species of the Russian genus.

2. Semishrubs 15–45 cm high, with large stems, 0.8–1.5 mm in diameter; leaves fleshy; seeds rather large, 2.5 mm long, 1 mm wide 4. *A. buschiana* Pojark.
- + Small semishrubs, 3–4 or 4–15 cm high, with slender shoots 0.5 mm thick and smaller seeds 3.
3. Leaves thin, broad, bright green; shoots of the first year very thin, 0.15–0.4 mm in diameter, filiform; stems of the previous year many, brown, thus giving the plant a very typical habit (series *Filiformes*) 4.
- + Leaves fleshy or thin, or oblong-elliptic; stems thicker, those of the previous year not preserved 5.
4. Stipules ovate to lanceolate, incised at margin; petioles (except for those of upper leaves) less than $\frac{2}{3}$ to more or less as long as blade; disk glands of staminate flowers incised or shallowly 2-lobed, lobes broad; stems very thin, filiform, 0.15–0.3 mm in diameter 9. *A. fedtschenkoi* Koss.
- + Stipules broadly ovate, irregularly large-toothed at margin; petioles one-half to two-thirds as long as blade; disk glands 2-partite for one-half to two-thirds into rather narrow lobes; stems thicker, 0.3–0.4 mm in diameter 8. *A. filiformis* Pojark.
5. Leaves rather thin, green, oblong-elliptic, acuminate at both ends; disk glands of staminate flowers shallowly incised
- + *A. stenophylla* Koss.
- + Leaves thick, fleshy, grayish-glaucous, orbicular, obtuse, sometimes short-mucronate; glands of staminate flowers 2-lobed or 2-partite 6.
6. All leaves with distinct petioles one-third to one-half as long as blade; staminate flowers small; sepals 1.3–1.5 mm long, ovate, obtuse; filaments connate up to middle; disk glands in staminate flowers parted into obtuse lobes, in pistillate flowers cut for one-third; petals of pistillate flowers shorter than disk lobes, tetragonal 6. *A. pygmaea* Koss.
- + Lower leaves only distinctly petioled, the others sessile or subsessile; staminate flowers larger; sepals 2–2.5 mm long, lanceolate-oval, acuminate in staminate flowers, obovate and abruptly tapering to short mucro in pistillate flowers; disk glands of staminate flowers narrowly and acutely lobed, lobes obtuse in the pistillate flowers; filaments connate only at base; petals of pistillate flowers narrow, liguliform, longer than disk lobes . . . 5. *A. pusilla* Pojark.
7. Stem green at base, not woody; sepals of pistillate flowers broad, orbicular or ovate-rhombic, obtuse or acuminate
- + 2. *A. rotundifolia* C. A. M.
- + Stem woody at base; sepals of pistillate flowers acute or acuminate 8.
8. Sepals of pistillate flowers oblong-rhombic, acuminate, of staminate flowers lanceolate-oval or lanceolate, acuminate or acute; disk glands of staminate [?] flowers deeply dissected into long linear acute lobes; woody base of stems yellow-brown; leaves usually mucronate; stipules lanceolate, entire or incised only at base 1. *A. telephioides* L.

- + Sepals of pistillate flowers ovate or oblong-elliptic or obovate, obtuse; disk glands of pistillate flowers 2-lobed, with ovate, obtuse or acute lobes; woody base of stems brown-yellow; leaves obtuse, rarely short-acuminate; stipules ovate, incised at margin
 3. *A. virga-tenuis* Nevski.

Section 1. *TELEPHIOIDES* (Mönch) Endl. Gen. (1840) 119.— Seeds broad; disk glands deeply 2-partite.

Series 1. *Telephioideae* Pojark. in Bot. Zhurn. SSSR, XXV (1940) 342.— Disk glands with narrow acute lobes; sepals of pistillate flowers acuminate; leaves elliptic, acute.

In addition to the Russian species, the series includes *A. maroccana* Ball. in Morocco, *A. cretica* Pojark in Crete, *A. afghanica* Pojark in Afghanistan, and *A. somalensis* Pax in Somalia.

- 272 1. *A. telephioides* L. Sp. pl. (1753) 1014; Ldb. Fl. Ross III, 582; Boiss. Fl. or. IV, 1138 (excl. syn.); Shmal'g., Fl. II, 417; Grossg., Fl. Kavk. III, 24 (excl. var. *rotundifolia*); Kosinsk. in Bot. Mat. Gerb. Bot. Sada. II (1921) 79.— *A. telephioides* α . *genuina* Müll.-Arg. in DC. Prodr. XV, 2 (1862–1866) 236.— Ic.: Rchb. Ic. Fl. Germ. f. 4807; E. P. Pflanzenfam. III, 5 (1896) f. 11a.— Exs.: G.R.F. No. 1385.

Perennial; semishrubs, 7–40 cm high; stems many, developed from woody rhizome, simple, thin, woody at base, reddish-brown, smooth, densely leafy; stipules narrow, lanceolate, acuminate, entire or incised only at base; leaves glabrous, glaucous-green, elliptic or obovate, rounded or broadly cuneate at base, short-acuminate, 2.5–11 mm long, 1.75–6 mm wide, with 1–2 mm long petioles. Flowers 1–3 in axil; staminate flowers on 1–2 mm long filiform pedicels, pistillate flowers on thicker pedicels up to 5 mm long; sepals of staminate flowers thin, greenish, broadly white-margined, narrowly oblanceolate, acuminate, 1.5–1.75 mm long, 0.5–0.75 mm wide; petals cuneate and spatulate, 1–1.45 mm long, 0.4–0.7 mm wide, obtuse or incised at apex, with $\frac{3}{4}$ as long as sepals; disk glands dissected into long acuminate lobes; sepals of pistillate flowers thick, green, narrowly white-membranous at margin, oblong-rhombic, 2.75–2.5 mm long, 1–1.5 mm wide, acuminate; petals rudimentary, shorter than the short obtuse disk lobes; capsules flattened-globose, 3–3.25 mm in diameter; seeds 1.5–1.75 mm long, 0.75–1.5 mm wide. May–September. (Plate XV, Figure 2.)

Dry stony limestone slopes. — European part: Crim.; Caucasus: W. Transc., E. Transc. (Kirovabad, Somkhetia). Gen. distr.: Med., Bal.-As. Min. Described from S. Europe. Type in London.

Series 2. *Rotundifoliae* Pojark. — Disk glands with broader and more obtuse lobes; sepals of pistillate flowers obtuse, rarely acute; leaves orbicular or obovate, obtuse. May–September.

Included here in addition to the Russian species are *A. ramosa* Pojark. in C. Iran and *A. stocksii* Pojark. in Baluchistan.

2. *A. rotundifolia* C.A.M. in Eichw. Pl. nov. casp.-cauc. (1831) 18; Ldb. Fl. Ross. III, 2, 582; Kosinsk. in Bot. Mat. Gerb. Bot. Sada. II (1921) 81. — *A. telephioides* γ. *rotundifolia* Müll.-Arg. in DC. Prodr. XV, 2 (1862–1866) 236; O. and B. Fedch., Perech. r. Turk. VI, 314; Grossg., Fl. Kavk. III, 25. — *A. asperula* Nevski in Tr. Bot. Inst. AN SSSR, ser. I, 4 (1937) 263. — *A. Vvedenskyi* Pazij in Bot. Mat. Gerb. Inst. Bot. i Zool. AN UzbSSR. XI (1948) 22. — Ic.: C.A.M. l. c. tab. 21. — Exs.: Herb. Fl. Cauc. No. 478; H.F.A.M. No. 301.

- 273 Perennial herbs or semishrubs up to 40 cm high; stems developed from woody rhizome, many, decumbent or ascending, more or less arcuate to straight, simple or branching, densely leafy, usually finely ribbed, often scabrous with fine papillae, sometimes quite smooth, often — especially in young specimens — green above, woody and brown at base, older larger specimens with perennial base of stems thickened and branching and often elevated thus the whole plant appearing a semishrub; stipules broad, ovate, irregularly toothed at margin; petioles much varying in length, those of the larger leaves (at lower part of stem) usually developed, reaching one-third to one-half the length of the blade, those of the other leaves short 1–3 mm long; leaves orbicular, orbicular-elliptic or obovate, 2.5–12 mm long and wide, rounded, rarely cuneate or emarginate at base, rounded, rarely acuminate or more or less truncate at apex, sometimes mucronulate. Flowers 2–3, in axil, rarely solitary; staminate flowers on very short filiform pedicels, 0.5–2.5 mm long, with sepals 1.5–1.75 mm long, 1–1.25 mm wide, oval, obtuse, brownish-greenish, broadly white-margined; petals oval-cuneate, obtuse, three-fourths as long as sepals; glands deeply cut into narrow acute lobes; pistillate flowers on 1.5–5 mm long pedicels (in fruit up to 8–10 mm), with sepals 1.5–2 mm long, 1.25–2 mm wide, orbicular-rhombic, generally obtuse but often obtusely acuminate or acute; petals liguliform, not longer than the obtuse disk lobes; capsules flattened-globose to globose, 2.5 mm in diameter; seeds 1.5–2 mm long, 1–1.75 mm wide. April–September.

Dry mountain and foothill slopes. — Caucasus: Dag., E. and S. Transc.; Centr. Asia: Ar.-Casp. (Mangyshlak), Kyz. K. (outliers), Mtn. Turk., Pam.-Al. (in the southern part of the district, apparently only at its extreme west), T. Sh. (rare in the central and eastern parts, extreme locality in Syugaty Mountains, absent in the southern part of the district). Gen. distr.: Arm.-Kurd. (?), Iran. Described from Balkhan Bay at the eastern shores of the Caspian. Type in Leningrad.

Note. *A. asperula* Nevski from Kugitang was described as distinguished from *A. rotundifolia* by the erect branching stems lignified below, the longer petioles, the usually few flowers and the slightly acuminate sepals. However, scrutiny of herbarium material from the distribution area of *A. rotundifolia* prompts us to reject this species. Stems with lignified base commonly occur in the polymorphic *A. rotundifolia* probably in accordance with the conditions of growth (they are often observed in plants of the southern deserts of Central Asia) and age: the old, more robust specimens usually have stems, perennial and lignified at their lower part. Such is the typical (and only) specimen of *A. asperula*. With respect to the sepals, there is no correlation between their shape and
274 the degree of lignification of the stems or the length of petioles; the shape

varies in *A. rotundifolia* from rhombic to ovate, with the base obtuse or even acute not only in different individuals but also in a single plant or even one flower, and is of lesser taxonomic significance. The other characters attributed to *A. asperula* and it must be viewed as one of the many forms of *A. rotundifolia* without specific distribution area; *A. vvedenskyi* Pazij. should be likewise regarded. On the other hand, *A. virga-tenuis* Nevski, although very closely related to *A. rotundifolia*, has an isolated distribution area, and possesses a more constant assemblage of characters.

3. *A. virga-tenuis* Nevski in Tr. Bot. Inst. AN SSSR, ser. 1, vol. 4 (1937) 264.

Perennial semishrubs, 30–40 cm high; stems thin, erect, straight, smooth, sparsely leafy, woody and brown at base, 2.3 cm thick, with few thin, short, arcuate branches; stipules ovate, fimbriate at margin, white, brownish-purple at base; petioles 0.5–2(3) mm long, leaves orbicular to broadly elliptic, usually obtuse, rarely short-mucronate or incised, broadly cuneate at base, rather fleshy, 3–10 mm long, 2.5–7(9) mm wide. Flowers axillary, solitary or in pairs; staminate flowers on 1–2.5 mm long thin pedicels, the sepals thin, greenish, ovate, broadly white-margined; petals oval-cuneate, nearly half as long as sepals, disk glands deeply 2-partite into acute lobes; pistillate flowers on 3–6 mm long pedicels (up to 8 mm in fruit), with green, oblong-elliptic sepals, acute at apex and narrowly white-margined; petals very small, liguliform; glands 2-lobed, obtuse; capsules more or less flattened-globular to subglobose, 2.5–2.75 mm wide; seeds as in the preceding species. April–October.

Dry mountain and foothill slopes. — Centr. Asia: Pam.-Al. (in the south from Guzar, Baisun and Kugitang to Darvaza). Gen. distr.: probably occurs in the neighboring regions of Afghanistan. Described from the red soils of Kugitang. Type in Leningrad.

Note. *A. virga-tenuis* is a S. Central Asian race common to the mountains of S. Tadzhikistan and the southern slopes of Gissar Range. Apparently the typical *A. rotundifolia* does not occur in this region (except for its extreme western part). *A. virga-tenuis* is rather similar to the latter and it is very difficult at times to distinguish between
277 them. It is identified by the erect, straight, always smooth stems, with their thickened, extensively woody base and by the longer, more acute sepals of the pistillate flowers. It is generally a larger plant and of a more distinct semishrubby habit.

Section 2. FRUTICULOSAE Pax et K. Hoffm. emend. Pojark. — Seeds oblong; disk glands usually shallowly 2-lobed.

Series 1. Fruticulosae Pojark. in Bot. Zhurn. SSSR, XXV (1940) 341. — Seeds 2.5 mm long. Semishrubs up to 30–45 cm high, with green branches, 0.8–1.5 mm in diameter, up to 5 mm in diameter at base.

In addition to the Russian species, the series includes three from Iran: *A. reflexa* Stapf. and *A. minutifolia* Pojark in the north and *A. fruticulosa* Boiss. in the south.



PLATE XV. 1—*Arachne colchica* (Fisch. et Mey) Pojark.; 2—*Andrachne telephioides* L.; 3—*Phyllanthus ussuriensis* Rupr. et Maxim.

4. *A. buschiana* Pojark. in Botan. Zhurn. SSSR, XXV, 4-5 (1940) 342. — "*A. suffruticosa* Boiss."? Fomin in Tr. Tifl. Bot. Sada, XI, 2 (1910) 186. — *A. fruticulosa* Schischk. in Bull. Mus. Georg. I (1922) 21, non Boiss.; G. Voron. in Sched. Herb. Fl. Cauc. X, 6 (1931) No. 477; Grossg., Fl. Kavk. III, 25. — Ic.: Pojark. l. c. f. l. — Exs.: Herb. Fl. Cauc. No. 477.

Perennial semishrubs; base of stems woody, up to 5 mm in diameter, pale brownish-gray, stems robust, 15-45 cm high, 0.8-1.5 mm in diameter, branching mostly at base, glaucous, smooth or scabrous only in lower part; stipules white, triangular or triangular-ovate, mucronate at apex, irregularly dentate at margins or sometimes only in the lower part; leaves thick, glaucous, glabrous, elliptic or broadly ovate, ca. 2.5 mm long, 2.25 mm wide (the upper), up to 7 mm long, 5.5 mm wide, acute or obtuse at apex and usually short-mucronate, with 0.5-1.5 mm long petioles. Flowers axillary, solitary or in pairs, rarely 3; staminate flowers on 1.5-2(2.5) mm long thin filiform pedicels, sepals thin, greenish-brown, broadly white-margined, 1.5-1.75 mm long, 1-1.25 mm wide, oboval, obtuse; petals about three-fourths as long as sepals, white, cuneate, rounded-truncate at apex; disk glands one-third as long as petals, incised for one-third into 2 lobes, lobes obtuse, filaments half-connate; pistillate flowers on thicker, 2-2.5 mm long pedicels (3-3.5 mm in fruit), sepals thick, green, narrowly white-membranous at margin, elliptic, acute, 2 mm long, 1.25 mm wide; petals very small, ligulate form; disk glands shallowly 2-lobed; capsules 3 mm long and wide, ovoid-globose, smooth, distinctly netted-veined; seeds trihedral, narrow, 2.5 mm long, 1 mm wide. Fl. and Fr. April-October.

278

Dry stony slopes. — Caucasus: S. Transc., in Aras R. valley. Endemic. Described from Dzhulfa. Type in Leningrad.

Note. *A. buschiana* is confused with the vicarious *A. fruticulosa* Boiss. which is distinguished from the Russian species by lower stature (5-10 cm high), small, narrowly elliptic, subsessile leaves, shorter petals of the staminate flowers with more deeply incised glands and mucronate sepals of the pistillate flowers.

Series 2. *Pusillae* Pojark. — Seeds 1.25-1.5 mm long; filaments connate for one-fourth to one-half of their length; leaves more or less fleshy; low semishrubs, 7-12 cm high, with strongly branching stems woody and thickened at base hardly ascending above ground, forming tufts or even cushions together with numerous thin green shoots of the preceding year 0.2-0.5 mm in diameter.

In addition to the Russian species, *A. pulvinata* Pojark. from northern Iran is included in this series.

5. *A. pusilla* Pojark. sp. nov. in Addenda XIII, 733. —

Perennial; small semishrubs up to 12 cm high; root strongly branching, brown, thickened (up to 5 mm in diameter), woody; shoots thin, simple (not branching), densely leafy, 0.3-0.5 mm in diameter; stipules peltate, broad, cut at margin and long mucronate at apex, at first white with narrow purple stripe at base, later turning brown; leaves pale, glaucous, orbicular or orbicular-elliptic, obtuse and sometimes short-mucronate at apex, broadly

cuneate or truncate at base, lower leaves with petioles one-third as long as blade, the others sessile or subsessile. Flowers solitary, axillary; staminate flowers on 1.5–2.5 mm long pedicels; sepals 1.75–2 mm long, 0.6–0.7 mm wide, oval-lanceolate, acuminate; petals white, three-fourths as long as sepals, 1.2–1.4 mm long, 0.3–0.4 mm wide, narrow, liguliform, truncate at apex; glands dissected into narrowly oval acute lobes; filaments connate below for one-fourth to one-third their length; pistillate flowers on 2.5–3 mm long pedicels; sepals 2–2.5 mm long, 0.7–0.9 mm wide, thick, green, narrowly white-membranous at margin, oblong-oval, acute or rounded, abruptly cuspidate at apex; petals 0.5–0.75 mm long, 0.2 mm wide, narrowly liguliform, slightly longer than lobes of disk glands; disk lobes obtuse, ovate; capsules flattened-globose, smooth, 1.75 mm long, 2.25 mm wide; seeds 1.25–1.5 mm long, 0.4–0.7 mm wide. Fr. September. (Plate XVI, Figure 2.)

- 279 Limestone crevices. — Centr, Asia: Pam.-Al. Endemic. Described from Gazimailik Mountains in S. Tadzhikistan (so far the only locality). Type in Leningrad.

Note. *A. pusilla* is almost indistinguishable from *A. pygmaea* Koss. in habit, but the many peculiarities (pointed out in the Key) in the structure of the staminate and pistillate flowers are of substantial taxonomic significance and should suffice to separate it.

6. *A. pygmaea* Koss. in Bot. Mat. Gerb. Bot. Sada. II (1921) 88.

Perennial; very small semishrubs, 3–4(8) cm high, with woody perennial branching base; stems numerous, thin, herbaceous, leafy, 0.1–0.4 mm in diameter; stipules white, later turning brown, with dark spot at base, distinctly dissected at margin; leaves 2.5–4.5 mm long and wide, elliptic or ovate-orbicular, obtuse or slightly acuminate at apex, broadly cuneate and slightly decurrent at base, glaucous-green, thick, with very short petioles 1.5–2.5 mm long, much shorter than blade. Flowers 2 or 1 in axil; staminate flowers on 1–1.5 mm long pedicels, sepals brownish or brownish-green, oval, obtuse, 1.4–1.5 mm long, 0.7–0.8 mm wide; petals cuneate, white, 0.9–1.1 mm long, 0.35–0.5 mm wide; disk glands 2-lobed, lobes obtuse; filaments half-connate; pistillate flowers with green broad ovate-rhombic or broadly oval sepals, white-membranous at margin, acute or obtuse, 1.3–1.5 mm long; petals tetragonal, shorter than disk lobes; capsules globose, 0.5 mm wide; seeds 1.2–1.3 mm long, 0.4–0.5 mm wide. Fl. and Fr. from May.

Dry mountain slopes. — Centr. Asia: Pam.-Al. (northern slope of Alai Range). Endemic. Described from near Osh. Type in Leningrad.

Series 3. *Stenophyllae* Pojark. — Seeds 1.2–1.3 mm long; filaments connate for two-thirds. Small, 3–15 cm high semishrubs with the perennial parts of stems woody and elevated above ground; stems leafy, 0.4–0.7 mm in diameter. One species known.

7. *A. stenophylla* Koss. in Bot. Mat. Gerb. Bot. Sada. II (1921) 91.

Perennial; small semishrubs 3–14 cm high; perennial basal parts of old stems branching, brown and brown-gray, reaching 2–3 mm in diameter, shoots many, thin, greenish-gray, scabrous, 0.4–0.7 mm in diameter, usually

280 leafless below, densely leafy above; stipules ovate, white, with purple spot at base, later becoming brown to nearly black, incised at margin, leaves 3.7 mm long, 1.5–2 mm wide, elliptic, glaucous, rather thin, more or less regularly acuminate at both ends; petioles half as long as blades, thick. Flowers 1, rarely 2, axillary; staminate flowers on 3.7 mm long pedicels; sepals brownish-green with white margin, oval-elliptic, acute, 1.5 mm long, 0.5–0.8(1) mm wide; petals cuneate, truncate at apex, white, two-thirds to three-fourths as long as sepals; disk glands shallowly lobed, lobes obtuse, wide; pistillate flowers on 3 mm long pedicels, sepals green, white-membranous at margin, lanceolate to ovate, acute or acuminate, 1.5–2 mm long, 0.8–1 mm wide; petals liguliform, 0.4–0.7 mm long, sometimes shorter than glands; glands only with shallow incision. Capsules flattened-globose, 2 mm long; seeds oblong, 1.2–1.3 mm long, 0.6 mm wide. Fl. and Fr. from April. (Plate XVI, Figure 3.)

Slopes and ravines, rock crevices. — Centr. Asia; Mtn. Turkm. (Kopet-Dagh and Greater Balkhan ranges). Gen. distr.: Iran. Described from Kizyl-Arvat. Type in Leningrad.

Series 4. **Filiformes** Pojark. — Semishrubs, wood base of old stems very strongly branching, annotinous stems numerous, persistent, brown; shoots leafy, 1.5–0.4 mm thick; leaves thin.

8. *A. filiformis* Pojark. in Bot. Zhurn. SSSR, XXV, 4–5 (1940) 344. — Ic.: Pojark. l. c. f. 2.

281 Perennial; small semishrubs, 7–20 cm high; base of old stems up to 7 mm in diameter, brownish-gray, woody, much branching, bearing numerous usually simple, rarely few and short-branched annotinous stems, brownish-yellow, thin, 0.3–0.7 mm in diameter, and thinner leafy shoots, gray-green, 0.3–0.4 mm in diameter; stipules white, with small black-purple spot at base, ovate-triangular, acuminate, irregularly cut at margin; leaves thin, bright green, elliptic, acute, usually short-mucronate, cuneate at base, 2.75–6 mm long, 2–3 mm wide, with thin petioles 1.5–2 mm long. Flowers 1, rarely 2, axillary, on thin-filiform pedicels; pedicels of staminate flowers 2–3 mm long, of pistillate flowers up to 5 mm long; sepals of staminate flowers thin, greenish-white, brownish at base, 1.5–2 mm long, 0.75–1 mm wide, concave, obovate, acute; petals 1–1.5 mm long, 0.75 mm wide, oboval, truncate or rounded at apex; disk glands cut for one-half to two-thirds into 2 rather narrow ovate lobes one-third as long as petals; filaments half-connate; sepals of pistillate flowers green, narrowly membranous-white at margin, elliptic, obtuse or acute, 1.5–1.85 mm long, 0.75–1.25 mm wide; petals white, liguliform or tetragonal, 0.3–0.4 mm long; disk glands bipartite; capsules globose, 2–2.5 mm in diameter; seeds 1.5 mm long, 0.6 mm wide.

Dry slopes. — Caucasus: S. Transc. Endemic. Described from the Nakhichevan ASSR, from between the railway stations of Negram and Kizyl-Vank. Endemic? Type in Leningrad.

9. *A. fedtschenkoi* Koss. in Bot. Mat. Gerb. Bot. Sada. II (1921) 89. — *A. hapladena* Pazij in Bot. Mat. Gerb. Inst. Bot. i Zool. An UzbSSR, XI (1948) 20. — *A. rupestris* Pazij, l. c. p. 21.

Perennial; glabrous semishrubs 3–5(25) cm high; base of stems up to 7 mm in diameter, woody, brown, strongly branching; herbaceous stems numerous, thin-filiform, sparsely leafy, 0.15–0.3 mm thick, annotinous stems nearly as thin, brown, leafless; stipules white, brownish-purple at base, acute, irregularly narrowly cut at margin; leaves (1.5)2–11 mm long, up to 9 mm wide, thin, bright green, rarely glaucescent-green, ovate-elliptic or orbicular-ovate to oblong-obovate or sub lanceolate, obtuse or acute, cuneate and slightly decurrent at base, with petioles more than half to almost as long as blade (shorter in upper leaves). Flowers 1, rarely 2–3, axillary; staminate flowers on pedicels 4–5 mm long, 0.1 mm thick, sepals concave, broadly or narrowly ovate or obovate, acute or obtuse, yellowish-green or pale green, brownish at base, 1.5–2 mm long; petals oval-cuneate, sometimes rather broadly linear, obtuse at apex, entire or notched or irregularly obtusely crenate, white, 1–1.3 mm long; disk glands incised or bipartite, lobes broad, 0.5 mm long, at first thick-fleshy, later scarious; filaments half-connate; pistillate flowers on thicker pedicels 0.2 mm in diameter; sepals thick, green, broadly elliptic or ovate, acute, narrowly white-margined, 1.5–2 mm long, 1.25–1.5 mm wide; petals 0.3–0.5 mm long, white, linear; glands shallowly lobed or slightly incised, lobes obtuse; capsules globose, 2–2.3 mm in diameter, smooth, finely netted-veined, sometimes with residual hairs; seeds 1.5–1.75(2) mm long, 0.5–0.7 mm wide. May–August. (Plate XVI, Figure 1.)

Stony mountain slopes, rock crevices. — Centr. Asia: Pam.-Al. (Zeravshan Range, Baisun Mountains, Kugitang). Endemic. Described from Zeravshan Range. Type in Leningrad.

Note. *A. hapladena* Pazij and *A. rupestris* Pazij can hardly be recognized as species differing from *A. fedtschenkoi* Koss. In the case of *A. hapladena* (from Yakkabag) the differences, such as lower
 282 habit (4–5 cm), small leaves ((5–6 mm long, 3.5–5 mm wide), staminate flowers with petals emarginate at the apex, glands incised and not 2-lobed, and larger seeds, cannot be considered as diagnostic characters (except for the latter character) because they are actually present in the original specimens of *A. fedtschenkoi*. The misunderstanding is probably due to the imprecise and undetailed original description of *A. fedtschenkoi*. Among the original specimens from Zeravshan there are individuals of small measurements — 3–7 cm high (which is not mentioned in the diagnosis) — with small leaves (2–7 cm [sic] long) which is typical for this species. In the diagnosis of *A. fedtschenkoi* there is obviously a misprint in the dimensions of the leaves — "1.5–2 cm" — since the leaves of the herbarium specimens are not more than 10–11 mm wide and 9 mm long [?]. Petals notched or more or less crenate at the apex are also observed in specimens from other localities (Zeravshan, Baisun). Disk glands may vary in shape, even in one flower, from shallowly incised to parted. The slightly larger seeds (2 mm long — whereas in the original specimens 1.5–1.75 mm) do not provide the basis for a specific rank.

With respect to the second species, *A. rupestris* Pazij (from Kugitang Range), it differs from the specimens of *A. fedtschenkoi* only by narrower leaves (oblong or lanceolate) thus approaching the narrow-leaved specimens from Baisun. The report of verrucose, not reticulate fruits in duplicate specimens of *A. rupestris* at the Herbarium

of the Botanical Institute of the Academy of Sciences of the USSR has not been confirmed. The fruits in these specimens are smooth and covered with the same thin network of veins when mature. It is possible that what were presumed to be verrucae were in fact the remains of thick hairs (also preserved in the fruits of the duplicate specimens).

Subtribe 2. **PHYLLANTHINAE** Pax in E. P. Pflanzenfam. III, 5 (1896) 17. — Leaves entire, alternate; flowers axillary, staminate flowers usually in clusters, rarely in 1–2; pistillate flowers solitary, rarely in clusters; petals obsolete; disk glands opposite petals; stamens (2)3–15; style dilated at apex; ovary with 2 ovules in each cell.

Genus 850. **SECURINEGA** * Comm.

Comm. in Juss. Gen. pl. (1789) 388

283 Dioecious (Russian specimens) or monoecious plants; sepals 5, petals obsolete; staminate flowers clustered in axils, with 5 glands alternating sepals and 5–6 (sometimes more) stamens, rudimentary ovary 2–3-lobed; pistillate flowers solitary or in few-flowered clusters; style 3-lobed; ovary 3-locular, with 2 ovules in each cell; fruit dry, 3-lobed, separating along cells, with 2 seeds in each cell; seeds without ventral protrusion, with thin coriaceous coating; embryo erect. Shrubs with alternate entire leaves and small coriaceous stipules.

About 15 species, distributed in the warm moderate zone of tropical S. America and the West Indies, on the Mascarene Islands, Arabia, SE Asia, Cape Region (1 species), and in the W. Mediterranean (1 species).

1. *S. suffruticosa* (Pall.) Rehd. in Journ. Arn. Arb. XIII (1932) 388. — *S. ramiflora* Müll.-Arg. in DC. Prodr. XV, 2 (1866) 449. — Kom., Fl. Man'chzh. II, 680; Kom. and Alis., Opr. rast. Dal'nevost. kr. II, 705. — *Xylophylla ramiflora* Ait. Hort. Kew. I (1789) 376. — *Pharnaceum suffruticosum* Pall. It. III (1776) app. 716. — *Phyllanthus ramiflorus* Pers. Syn. II (1807) 591. — *Geblera suffruticosa* Fisch. et Mey. in Ind. sem. hort. Petrop. (1835) 22; Ldb. Fl. Ross. III, 2, 583; Turcz. Fl. baic.-dah. II, 88; Rupr. in Maxim. Prim. Fl. Amur. (1859) 239. — *Geblera sungarensis* Rupr. in Bull. Phys.-Math. Acad. Petr. XV (1857) 357. — *Flueggea suffruticosa* Baill. Etud. Euph. (1858) 592. — *Acidoton ramiflorus* O. Ktze. Rev. Gen. (1891) 592. — Ic.: Pall. l. c. tab. E, f. 2; Kom. and Alis., l. c. tab. 212, f. 1 and 3–7. — Exs.: F. Karo, Pl. amur. et zeaëns. No. 253.

Spreading shrub up to 1.5–2 cm high, with thin virgate erect glabrous pale yellow shoots, older branches with gray bark; leaves glabrous, somewhat coriaceous, elliptic or oval-lanceolate, rarely obovate, rounded or acute at apex, cuneate at base, (1.2)1.5–7 cm long, (0.4)0.6–3.5 cm wide, entire or irregularly erose-dentate (often above middle) at margin; petioles 2–4 mm long. Flowers dioecious, greenish-yellow or green; staminate flowers in clusters of (2)3–12(15), on (1.5)2–4(6) mm long

* From the Latin *securis* — axe, and *negare* — negate, deny, indicating the very hard wood.

peduncles; sepals concave, oval, 2 mm long; stamens exserted from calyx; glands dentate, rudimentary ovary usually 3-parted; pistillate flowers solitary, rarely 3–8, on longer, up to 1 cm long erect peduncles, thickened above; ovary spherical; styles 3, dilated above, 2-partite up to middle; fruit 3-locular, globose, flattened above, 3-lobed; seeds smooth, obtusely trihedral, with thin testa. Fl. June, Fr. from September. (Plate XVI, Figure 4.)

East Siberia: Dau. (Nerchinskaya Dauria); Far East: Ze.-Bu., Uss. Gen. distr.: Jap.-Ch. (Korea, Manchuria). Described from Dauria. Type in London.

Economic importance. Often grown as an ornamental plant.

284 Genus 851. **FLÜGGEA*** Willd.

Willd. Sp. pl. IV (1805) 757

Plants dioecious or monoecious; flowers unisexual with 5 petals, apetalous, clustered in axils; staminate flowers with 5 glands alternating sepals, stamens 4–5, exceeding sepals; pistillate flowers with annual lobate disk and 3-locular ovary with 2 ovules in each cell; fruit berry-shaped; seeds with hard woody testa, with protrusion at the ventral side; embryo bent. Shrubs, with entire leaves; stipules small, coriaceous.

About 10–12 species, almost all in the tropical countries of the Old World: Africa, Australia, SE Asia (E. Himalayas and SE China). One species grows in C. China (Hupeh province) and another can be found in the Maritime Territory of the USSR.

1. *F. ussuriensis* Pojark. sp. nov. in Addenda XIII, 734.

Shrubs, with thin virgate young branches and shoots, covered with green glabrous bark, densely black-punctate; leaves glabrous, 1.8–7 cm long, 0.6–3.3 cm wide, obovate, acute or tapering to short mucro, cuneate at base, revolute at margin, sometimes finely undulate as if crenate, dark green above, lighter, glaucescent beneath, opaque on both sides, slightly rugose, with lateral nerves, deeply embedded in upper part, strongly protruding below. Flowers dioecious, staminate flowers 5–20 in a cluster, on 3–5(6) mm long glabrous peduncles; sepals 5, broadly obovate or elliptic, 1.5 mm long, 0.8 mm wide, concave, obtuse, crenate above at margin; petals obsolete, glands tapering at base; stamens 5, rarely 4, longer than sepals, anthers broadly oval; rudimentary ovary fissured up to middle or slightly higher; pistillate flowers and fruit unknown. Fl. in August. (Plate XVI, Figure 5.)

The specimen collected by V. L. Komarov is the only one known. Far East: Uss. (near Kondratenkovo at the mountain forest edge). Endemic? Type in Leningrad.

* Named after the botanist J. Flügge, who published a monograph on cereals (1810).



PLATE XVI. 1—*Andrachne fedtschenkoi* Koss.; 2—*A. pusilla* Pojark.; 3—*A. stenophylla* Koss.; 4—*Securinega suffruticosa* (Pall.) Rehd.; 5—*Flüggea ussuriensis* Pojark.; 6—*Pachysandra terminalis* S. et Z.

287 Note. The main morphological differences between *Flüggea* and *Securinea* are in the structure of their fruits and seeds. Although the specimen in our possession is with staminate flowers only, we think it to be *Flüggea*, which has been unknown to the Russian flora. The genus is distributed in Asia, mainly in its tropical part from where only one species expands to the north in Central China. The flowers of our plant have long stamens (2 to 2.5 times longer than the sepals), which is usually common to *Flüggea*, whereas in the Asiatic species of *Securinea* they usually do not exceed the calyx by more than 1.5 times. Moreover, solitary flowers with 4 stamens are found among the common 5-staminate flowers, which is also characteristic for *Flüggea*, while 5–6 stamens, rarely more, are common in *Securinea*. As to the features of the leaves (shape, color, prominent nerves), our plant shows no similarity to those of the species of *Securinea*, but similar obovate leaves with prominent nerves are typical of the Asiatic species of *Flüggea* which are grouped under the general, species-aggregate "*Flüggea leucopyrus* Willd." Our plant differs from the Himalayan specimens by narrower leaves and pale shoots.

Genus 852. **PHYLLANTHUS*** L.

L. Sp. pl. (1753) 981

Monoecious (Russian) or dioecious plants; flowers with 4–6 sepals, apetalous; stamens usually 3, rarely 2–5, or more, filaments free to more or less connate; ovary 3-locular; fruit dry, splitting; seeds trihedral, without appendage. Annual herbs (in the USSR).

More than 400 species, distributed mostly in the tropical countries.

1. *Ph. ussuriensis* Rupr. et Maxim. in Bull. Phys.-Math. Acad. St.-Petersb. XV (1857) 222; Maxim. Prim. Fl. Amur. (1859) 241; Kom. and Alis., Opred. rast. Dal'nevost. kr. II, 705. — *Ph. simplex* Kom., Fl. Manch'zh. II (1903) 683 (non Retz.).

Small annuals, branching at base; stems 5–20 cm long, flat, slightly winged; stipules ca. 1 mm long, coriaceous, obliquely oval, acuminate; leaves glabrous, subsessile, lanceolate, oval-lanceolate or elliptic, 5–20(25) mm long, 1.5–7 mm wide, acute and short-acuminate at apex, mucronate, notched at base. Flowers solitary or in pairs, axillary, the staminate and pistillate often sitting side by side in the same axil; pedicels very short, filiform in staminate flowers, thickened above in pistillate flowers; sepals usually 6, triangular, acute, greenish or slightly reddish, much larger in pistillate flowers; styles deeply 2-partite; ovary more or less densely squamose-papillose to glabrous; fruit globose-flattened, ca. 3 mm in diameter, squamose-verrucose to glabrous; seeds trihedral, dotted-tuberculate. Fr. August. (Plate XV, Figure 3.)

Granite outcrops, rock crevices, pebbly slopes, dry clayey slopes, sandy riverbanks, often in large quantities. — Far East: Uss. Gen. distr.: Jap.-Ch. Described from Ussuri River. Type in Leningrad.

* From the Greek *phyllon* — leaf, and *anthos* — flower.

Subfamily 2. **CROTONOIDEAE** Pax in E. P. Pflanzenfam. III, 5 (1896)
 14.— Ovules 1 in each cell of ovary; latex vessels usually present.

Tribe 1. **CROTONEAE** Pax. 1. c. Stamens sharply bent inward at aestivation.

Subtribe 1. **CHROZOPHORINAE** Pax in E. P. Pflanzenfam. III, 5 (1896)
 42.— Flowers with petals, with or without disk, in racemiform or spicate inflorescences; stamens 4–30, with free or more or less connate filaments; styles entire or 2-partite or multipartite; ovary with 1 ovule in each cell.

Genus 853. **CHROZOPHORA** * Neck.

Neck. Elem. II (1790) 337.— Tournesol Adans. Fam. pl. II (1763) 386.— Tournesolia Scop.
 Introd. hist. pl. (1777) 243.— Ricinoides Moench, Method. (1794) 286.— Lepidocroton Presl. Epimel.
 bot. (1850) 213

Flowers in short racemiform inflorescences in axils of upper leaves, unisexual, plants monoecious; staminate flowers with petals more or less as long or slightly shorter than sepals, glands absent; stamens (3)4–10 (11–12) in 1–3 whorls, filaments usually more or less connate; pistillate flowers with petals shorter than sepals or absent, glands forming a disk with short broad lobes alternating petals; styles 2-partite; ovary 3-locular, with 1 ovule in each cell; fruit a slightly fleshy 3-locular capsule; seeds without appendage. Annual herbs, rarely semishrubs.

Eleven species, distributed throughout the tropical parts of E. and N. Africa, over the entire Mediterranean area, in Arabia, Central Asia and India. One species reaches Indochina..

289 **Economic importance.** The species of *Chrozophora* contain such small quantities of indigo that they are scarcely worth cultivating for this purpose. They are sometimes used domestically for dyeing.

1. Ovary and fruit thickly covered with stellate hairs 2.
- + Ovary and fruit covered with flat white peltate scales 3.
2. Seeds light brown, shining, smooth, sometimes with yellowish spots of a partly adnate thin membrane (the inner layer of the endocarp usually united with the fruit-wall) 1. *C. sabulosa* Kar. et Kir.
- + Seeds dark brown, dotted-pitted, usually the texture is covered by a thin scarious layer of endocarp and the seeds appearing finely and unevenly tuberculate 2. *C. gracilis* Fisch. et Mey.
3. Stamens usually 10–11(19–12); leaves broad, grayish, velutinous-pubescent, often subglabrous when mature; ripe fruit beset with conical tubercles 3. *C. tinctoria* (L.) Juss.
- + Stamens 3–8(9), usually 5–7 4.
4. Ripe fruit smooth or only with solitary conical tubercles; leaves oblong, 1.5–2 times as long as wide, yellowish, densely tomentose-pubescent, usually entire 5. *C. obliqua* Juss.

* From the Greek *chros* — color, and *forein* — to carry, indicating the presence of dyeing substances.

Ripe fruit markedly covered with conical tubercles; leaves all or almost all broad (more or less as broad as long), grayish, velutinous-pubescent, dentate, rarely subentire 4. *C. hierosolymitana* Spr.

Section 1. *TRICHOCARPA* Prain in Kew Bull. 2-3 (1918) 89. — Ovary and fruit covered with stellate hairs.

1. *C. sabulosa* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 446; Ldb. Fl. Ross. III, 2, 581; Bge. in Mém. Acad. St. Pétersb. VII (1854) 490; DC. Prodr. XV, 2 (1866) 748; O. and B. Fedch., Perech. r. Turk. 5-6 (1913) 313, p. p. — *Ch. gracilis* Boiss. Fl. or. IV, 1140, non Fisch. et Mey. — Exs.: H. F. A. M. No. 302.

290 Annuals, 5-25 cm high, wholly gray-tomentose with stellate hairs; stems spreading, branching; petioles 3-9 mm long, curved; blade ovate or rhombic-ovate, obtuse or acute, rounded or cuneate often oblique at base, 2-6 cm long, 1.5-4 cm wide, entire or dentate, short-hairy above, softly villous-hairy beneath. Inflorescences short, ca. 1 cm long, crowded in axils of upper leaves; staminate flowers subsessile, in upper part of inflorescence; sepals and petals 5, sepals linear-lanceolate, covered stellate-hairy outside, petals slightly longer than sepals, yellow above, outside with shining stellate and subsquamiform hairs, inside with long thick simple hairs; stamens 5, sometimes 3-4, filaments from the middle; anthers narrowly oval, oblique; pistillate flowers 2-6, on long drooping pedicels up to 4 cm long in fruit; sepals and petals linear, acute, nearly equal, densely stellate-hairy outside; ovary densely stellate-hairy; styles bi-sect; fruit trihedral, flattened-spherical, 5 mm long, 7 mm wide, stellate-hairy; seeds smooth, 3-4 mm long, ovate. June-September.

Sandy deserts. — Centr. Asia: Ar.-Casp. (SE), Balkh., Kyz. K., Amu. D., Syr D. **Gen. distr.:** Dzu.-Kash. Described from Dzungaria (Sassyk-Pastau and Arganat Mountains). Type in Leningrad.

Note. Specimens of this species completely without hairs or only with a few stellate ones along the leaf margins, known as var. *nuda* Pojark. var. nov., have been found near Dzhambul in Kazakhstan.

2. *C. gracilis* Fisch. et Mey. ex Ldb. Fl. Ross. III, 2, 581; Fisch. et Mey. ex Kar. in Bull. Soc. Nat. Mosc. XII (1839) 171, nom. nud. — *Ch. sabulosa* Pax et Hoffm. in Pflanzr. IV, 147, VI (1912) 27, p. p.; in Pflanzenfam. 2 ed. 19, C (1931) 91, p. p.; O. and B. Fedch., Perech. r. Turk. 5-6, 313 p. p.; Prain in Kew Bull. (1918) 98, p. p. — *Tourne-solia gracilis* O. Ktze. Rev. gen. II (1851) 621, quoad nom. — *Ch. pannosa* Pazij in Bot. Mat. Gerb. Inst. Bot. i Zool. AN UzbSSR, XI (1948) 25.

Similar to the preceding species in all parts, distinguished by the dark brown, finely dotted-scabrous seeds usually covered with a thin membrane (inner layer of endocarp?), in contrast to the seeds of *C. sabulosa*, thus appearing gray or grayish-brown, finely and unevenly tuberculate.

Sandy deserts. — Centr. Asia: Ar.-Casp. (western part of Mangyshlak Peninsula only), Kara K., Mtn. Turkm. (foothills). **Gen. distr.:** probably N. Iran, in that part adjacent to the southern part of Kara-Kum region. Described from the Dardzha Peninsula on the eastern banks of the Caspian (NW Turkmenia). Type in Leningrad.

Section 2. LEPIDOCARPA Prain in Kew Bull. 2-3 (1918) 98. —
Ovary and fruit covered with flat white scales.

3. *C. tinctoria* (L.) A. Juss. Euphorb. Gen. Tent. (1824) 28; M. B. Fl. taur.-cauc. II, 409, p. p.; excl. pl. cauc.; Ldb. Fl. Ross. III, 2, 581, p. p.; Boiss. Fl. or. IV, 140, p. p.; Shmal'g., Fl. II, 417, p. p.; Pax et Hoffm. in Pflanzenr. IV, 147, VI, 22, p. p.; Prain in Kew Bull. 2-3 (1918) 103. — *Croton tinctorius* L. Sp. pl. (1753) 1004. — *Ricinoides tinctoria* Moench. Meth. (1794) 281. — *Ch. tinctoria* var. *genuina* Müll. Arg. in DC. Prodr. XV, 2 (1866) 749. — *Tourne-solia tinctoria* Baill. Bot. med. (1884) 932. — Ic.: Rchb. Ic. Fl. Germ. tab. 152. — Exs.: Fl. exs. austro-hung. No. 41.

291 Annuals, with erect spreading-branching stem, sparsely tomentose with stellate hairs, often reddish, 10-60 cm high; leaves canescent-velutinous with stellate hairs (sometimes nearly glabrous towards end), rhombic or triangular-ovate, usually obtuse, rarely acute, rounded or broadly cuneate at base, dentate or partly entire, 4-6.5 cm long, 3-5 cm wide, with 3-6 cm long petioles. Inflorescences short, dense, 12-15 mm long; staminate flowers in upper part of inflorescence, subsessile; sepals 5, 3-5 mm long, lanceolate, acuminate; petals slightly longer than sepals, covered outside with whitish peltate scales; stamens in 2 whorls, usually 10, rarely 9, or 11-12, filaments connate for most of their length; anthers oblique; pistillate flowers on ca. 4 mm long pedicels, 1-4 on short peduncle; sepals narrowly linear; petals shorter than sepals, narrowly linear; ovary densely squamose styles deeply 2-partite; fruits trihedral, 6 mm long, 8-9 mm in diameter, tuberculate-squamose, on drooping pedicels 1-2 cm long; seeds 4-5 mm long, 3-4 mm in diameter, more or less trihedral, verrucose-scabrous. Fl., Fr. June-October. (Plate XVII, Figure 3.)

Weedy places, roadsides, dry slopes, among crops. — European part: Crim. Gen. distr.: throughout Med., Bal.-As. Min. Described from Montpellier. Type in London.

Note. *C. tinctoria* is a Mediterranean species which does not grow wild eastward of Asia Minor and Syria. In the USSR it grows wild only in the southern shores and the eastern part of the Crimea. In the Caucasus and Central Asia it is found very rarely and then only as an introduced plant among crops. *C. hierosolymitana* Spreng., whose habit strongly resembles *C. tinctoria* but is easily distinguished from it by the small number of stamens, 3-6(7-8) and the usually denser pubescence, has been misidentified in the Caucasus and Central Asia as *C. tinctoria*. Another species often accepted as *C. tinctoria* in Central Asia is *C. obliqua* (Vahl) Juss, known in the Russian literature under the synonymic name *C. verbascifolia* Juss.

4. *C. hierosolymitana* Spreng. Syst. veg. III (1826) 850; Prain in Kew Bull. 2-3 (1918) 109. — *Croton oblongifolium* Sieber ex Spreng. l. c. non Delil. — *Ch. Sieberi* Presl, Bot. Bemerk. (1844) 109. — *Ch. tinctoria* Ldb. Fl. Ross. III, 2 (1851) 581, p. p. (quoad pl. cauc.) non A. Juss.; Hook. Fl. Brit. Ind. V, 408; Lipskii in Tr. Tifl. Bot. Sada. IV (1899) 446; Pax et Hoffm. in Pflanzenr. IV, 147, VI (1912) 22, p. p.; Fedch., Rast. Turk. 558; O. and B. Fedch., Perech. r. Turk. VI, 313;

Grossg., Fl. Kavk. III, 25.— *Ch. verbascifolia* Baill. Étud. gen. Euphorb. (1858) 322, p. p. non Juss.; Boiss. Fl. or. IV, 1141, p. p.; Pax et Hoffm. l. c. 25, p. p.— *Ch. tinctoria* β . hierosolymitana Müll. Arg. in DC. Prodr. XV, 2 (1866) 249.— *Ch. cordifolia* Pazij in Bot. Mat. Inst. Bot. i Zool. AN UzbSSR, XI (1948) 23.— Exs.: G.R.F. 292 No. 2595 (sub. nom. *Ch. tinctoria*).

Annuals, stellate-hairy, with erect stem, 7–60 cm high; leaves canescent-velutinous, rarely more densely tomentose, broad (slightly longer than wide), ovate or rhombic-ovate, broadly cuneate or rounded at base, uppermost leaves sometimes oblong-ovate, strongly dentate at margin, rarely subentire, 1.3–7 cm long, 1.3–6 mm [sic] wide, petioles of the upper leaves longer than 1.5 cm, of the lower leaves up to 8 cm long. Inflorescence densely tomentose; staminate flowers on very short 1–1.5 mm long pedicels; sepals narrowly lanceolate-acuminate, petals hardly shorter, covered outside with white scales, purple-violet in lower part, yellow above; stamens 3–8, usually 4–6; pistillate flowers on pedicels up to 3 mm long, reaching 3 cm in fruit; sepals and petals linear-subulate, densely stellate-hairy outside; fruit 8–10 mm in diameter; tuberculate, beset with white scales; seeds 3–4 mm long, tuberculate-scabrous. Fl. June–October. (Plate XVII, Figure 2.)

Dry slopes, seashores, weedy places, sometimes among crops, in the foothills and the lower and central mountain belts of Central Asia among semidesert associations, sometimes in sands at desert margins.— Caucasus: all parts; Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh., Kara K., Kyz. K., sometimes introduced among crops. Gen. distr.: E. Med. Described from the vicinity of Jerusalem. Type not preserved?

Note. Up to the present time no one in the USSR has distinguished this species from *C. tinctoria* (L.) A. Juss., and it has been recorded for the Caucasus and Central Asia under that name.

5. *C. obliqua* (Vahl) A. Juss. ex Spreng, Syst. veg. III (1826) 850; Prain in Kew Bull. 2–3 (1918) 111.— *Croton argenteum* Forsk. Fl. aegypt. arab. cat. Aegypt. (1775) p. LXXV, non L.— *C. obliquum* Vahl. Symb. Bot. I (1790) 78.— *C. verbascifolium* Willd. Sp. Pl. IV (1805) 539.— *C. villosum* Sibth. et Sm. Fl. graec. prodr. II (1813) 249.— *C. patulus* Lagasca, Gen. et Sp. nov. (1816) 21.— *Chrozophora verbascifolia* A. Juss. Euph. gen. tent. (1824) 28; Boiss. Fl. or. IV, 1141, p. p. (excl. syn.: *Ch. hierosolymitana*); Pax et Hoffm. in Pflanzenr. IV, 147, V (1912) 26 (excl. syn.: *Ch. hierosolymitana* et *Ch. Sieberi*); Fedch., Rast. Turk. (1915) 558; Fed., Perech. r. Turk. VI, 313.— *Chr. integrifolia* Bge. Rel. Lehm. (1851) 314.— *Ch. tinctoria* α . *verbascifolia* Müll. Arg. in DC. Prodr. XV, 2 (1866) 748.— *Tournesolia verbascifolia* O. Ktze. Rev. gen. II (1891) 621.

Annuals, all parts densely yellow-tomentose with stellate hairs; stems 10–70 cm high, erect, spreading-branching; petioles 3–10 cm long; leaves oblong (1.5–2 times as long as wide), narrowly ovate or elliptic, upper leaves narrowly lanceolate, 2.5–9 cm long, 1–5 cm wide, acute, rarely obtuse, usually cuneate, rarely rounded at base, very often asymmetrical, generally entire, often undulate, sometimes strongly dentate. Inflorescence 1.5–3 cm long, very dense; staminate flowers subsessile in upper part of inflorescence;

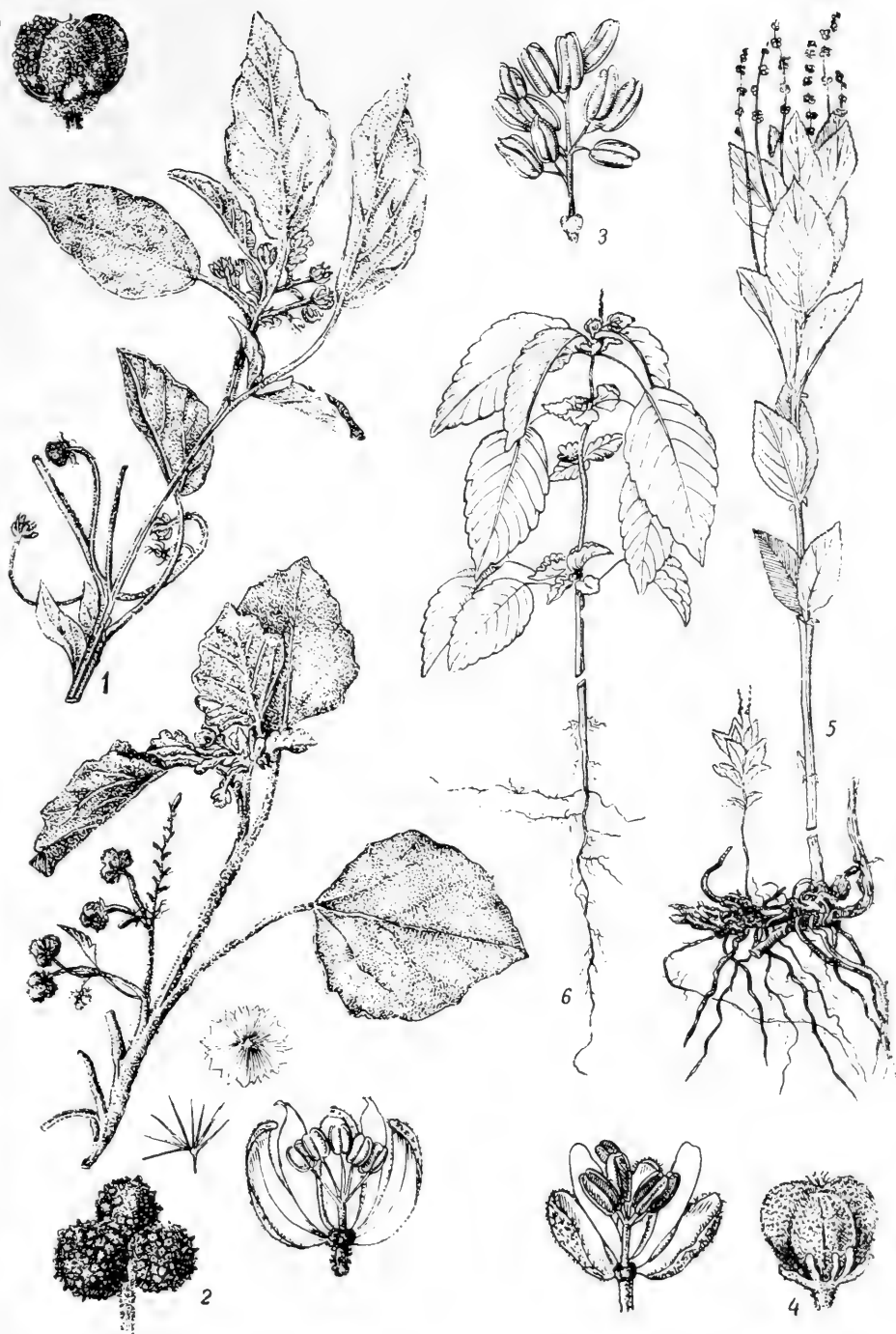


PLATE XVII. 1 - *Chrozophora obliqua* (Vahl) Juss.; 2 - *Ch. hierosolymitana* Spr.; 3 - *Ch. tinctoria* (L) Juss.; 4 - *Ch. sabulosa* Kar. et Kir.; 5 - *Mercurialis ovata* Stemb. et Hoppe.; 6 - *Acalypha australis* L.

sepals 5, lanceolate or oval-lanceolate, acute or acuminate; petals 5, slightly shorter than sepals; stamens 4–6, rarely 7–8(9), filaments connate for most of their length; anthers oblique; pistillate flowers 1–4 in the lower part of inflorescence, on 3–4 mm long pedicels; sepals and petals setaceous, densely stellate hairy, outside, more or less equal or petals slightly shorter; ovary squamose; styles 2-partite; fruit 5–6 mm long, ca. 8 mm in diameter, smooth or with solitary conical tubercles, densely covered with scales; seeds scabrous-verrucose, 4–5 mm long. Fl. and Fr. June–October. (Plate XVII, Figure 1.)

Foothills and the lower and central mountain belts, dry, open stony and fine-earth slopes, weedy places, among crops. — Centr. Asia: Mtn. Turkm., Pam.-Al., T. Sh. (W.). Gen. distr.: all Med., Egypt, Bal.-As. Min., Iran. Described from Egypt. Type in Copenhagen.

Note. *C. obliqua* is easily distinguished from *C. hierosolymitana* and *C. tinctoria* by the smooth, not tuberculate, slightly flattened fruits and the densely tomentose yellow leaves, and further from *C. tinctoria* by the number of stamens.

Subtribe 2. **MERCURIALINAE** Pax in E. P. Pflanzenfam. III, 5 (1896) 46. — Flowers apetalous, stamens free or connate, anther cells more or less spherical; styles large, styles connate only at base; ovary with 1 ovule in each cell.

Genus 854. **MERCURIALIS** * L.

L. Sp. pl. (1753) 1035

296 Dioecious, rarely monoecious, plants; staminate flowers in interrupted spikes, with spherical 3-partite calyx, apetalous, stamens 8–20 (usually 8–12), filaments free; pistillate flowers 1–2 in axils of bracts or in few-flowered racemiform or spikelike inflorescence, with 3 imbricate sepals and 2 filiform glands alternating carpels; ovary usually 2-locular, 1 ovule in each cell; seeds with appendage. Herbs with opposite leaves.

About 10 species growing in the Mediterranean area and 1 in Japan.

1. Annual plants, with branching stem; pistillate flowers subsessile, few in axils of leaves 3. *M. annua* L.
- + Perennials, with simple stem; pistillate flowers 1–4 on short or long scapes 2.
2. Leaves ovate, subsessile 2. *M. ovata* Sternb. et Hoppe.
- + Leaves narrower, ovate-elliptic or elliptic, with conspicuous 40–45 mm long petioles 1. *M. perennis* L.

1. *M. perennis* L. Sp. pl. (1753) 1035; M. B. Fl. taur.-cauc. II, 423; Ldb. Fl. Ross. III, 2, 580; Shmal'g., Fl. II, 418; Grossg., Fl. Kavk. III, 26. — *M. cynocrambe* Scop. Fl. carn. ed. 2, II (1772) 266. — *M. nemoralis* Salisb. Prodr. horti Chap. Allert. (1796) 390. — *M. sylvatica* Hoppe in Flora, I (1818) 472. — *M. longifolia* Host, Fl. austr. II (1831)

* Named after the mythological god Mercury.

666. — *M. Alpina* Schur, Enum. pl. Transsylv. (1866) 600. —
Synema perenne Dalac, Fl. Hautes Pyrées. (1867) 154. — Ic: Hegi,
III. Fl. V, 1, t. 177, f. 1.

Perennial, with creeping underground shoots; stems ascending, simple
glabrous or subglabrous below, more or less hairy above, generally leaf-
less below; leaves close together at apex of stem, 3–10 cm long, 1.5–4.5 cm
wide (lower leaves smaller than upper), lanceolate-oval or lanceolate-
elliptic, acuminate or acute at apex, cuneate at base (upper leaves some-
times more or less rounded at base), thin, dark green, sparsely scabrous-
hairy (usually only above), sometimes completely glabrous, crenate-serrate
at margin, with glabrous or pubescent petioles (40–45 mm long); stipules
membranous, white, long oval-lanceolate, ca. 2 mm long. Staminate flowers
subsessile, arranged in few-flowered glomerules, glomerules sessile in
axils of membranous ovate bracts, forming long interrupted spikes usually
longer than leaves, with axis thin and usually glabrous; sepals 3, ovate,
acute, glabrous, 2 mm long; stamens ca. 10; pistillate flowers in short
($\frac{1}{3}$ to $\frac{1}{4}$ as long as leaves) racemiform 1–4-flowered inflorescences in
axils of oval-lanceolate, acute, ca. 2 mm long bracts, pedicels 1.5–3 mm
long, slightly elongating in fruit; sepals 3, somewhat connate, oval, acumi-
nate, 2 mm long, glabrous; glands filiform, dilated at base; ovary hirsute,
sparsely papillate; styles connate at base, papillate inside; fruit flattened-
globose, 6–7 mm wide, 5 mm long, coarse-hairy; seeds subspherical, acute
at apex, 3 mm in diameter, grayish, pitted. Fl. end of April–May, Fr. May–
June.

Broadleaved and mixed forests. — European part: Lad.-Ilm., U. V.,
V.-Kama, U. Dnp., M. Dnp., V.-Don, Transv., Bl., Crim.; Caucasus:
Cisc., W. Transc. (Novorossiisk), Tal. Gen. distr.: nearly all Europe.
Described from Europe. Type in London.

Economic importance. Poisonous.

2. *M. ovata* Sterab. et Hoppe in Denkschr. Bot. Gesellsch. Regens-
burg (1815) 170; Ldb. Fl. Ross. III, 2, 580; Shmal'g., Fl. II, 418. —
M. livida Portenschl. ex Fuss, Enum. stirp. Transsylv. Mant. I (1846)
86. — *M. perennis* v. *ovata* Müll. Arg. in DC. Prodr. XV, 2 (1866)
796; Boiss. Fl. or. IV (1879) 1142. — Ic.: Sternb. et Hoppe. l. c.; Hegi,
III. Fl. V, 1, f. 1750.

Annual, with creeping rhizome; stems ascending, simple, 15–45 cm
high, sulcate, glabrous or subglabrous or appressed-hirsute in upper part,
uniformly leafy, the lower one–two nodes leafless or with small reduced
leaves; petioles very short, 1–2(2.5) mm long, glabrous or pubescent;
leaves 1.5–7.5 cm long, 1–4 cm wide, broadly ovate or broadly elliptic,
acuminate or acute, usually distinctly mucronulate, broadly cuneate or
rounded at base, subglabrous to spreadingly coarse-hairy, pale green,
rather dense but thin, often regularly crenate at margin; stipules oval-
lanceolate, white, 2–2.5 mm long. Staminate flowers subsessile, in few-
flowered (2–4 flowers, rarely up to 7) glomerules, glomerules sessile in
axils of white membranous, ca. 1.5 mm long bracts, 4–8 forming together
an interrupted spike on a long, thin and sparingly pubescent axis, 5–12 cm
long and much exceeding leaves; sepals 3, broadly ovate, acute, glabrous,
2 mm long; stamens 7–14; pistillate flowers on very short, 1–2 mm long
pedicels, forming raceme in upper part of axis 1.5–4.5 cm long and much
shorter than leaves; bracts ca. 2 mm long, ovate, acute; sepals 3, green,

oval, acute, somewhat connate at base; glands filiform, gradually extended to base; ovary densely coarse-hairy; styles papillate inside; fruit globose and slightly flattened, 3–4 mm long, 5.6 mm wide, coarse-hairy; seeds ovate-spherical, acute at apex, gray, finely pitted. Fl. April–May, Fr. May–June. (Plate XVII, Figure 5.)

- 298 Forests and shrubby formations. — European part: M. Dnp., Bl., Crim.; Caucasus: W. Cisc. Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Centr. Europe. Type unknown.

Note. Hybrids: *M. ovata* Stern. et Hoppe × *M. perennis* L. Stems more leafy and leaves more regular than in *M. perennis*; leaves usually ovate-elliptic, rarely elliptic, with conspicuous petioles (3–5 mm long). Collected in several places in the Crimea.

3. *M. annua* L. Sp. pl. (1753) 1035; Ldb. Fl. Ross. III (1849–1851) 581; Shmal'g., Fl. II, 418; Grossg., Fl. Kavk. III, 25. — Exs.: G. R. F. No. 2596, Pl. Finl. exs. No. 796.

Annual, 20–40 cm high; stem usually glabrous, branching from base; leaves opposite, ovate-lanceolate, acuminate above, rounded or slightly cordate or broadly cuneate at base, thin, slightly ciliate at margin, crenate-dentate, blade 2.5 times longer than petiole, with 1 gland at each side of base; stipules linear-lanceolate, white. Staminate flowers in glomerules forming an interrupted spike in upper part of axis, longer than leaves, 3–10 cm long; sepals 3, partly connate, ovate, acute, 1.5–2 mm long, glabrous; stamens 8–12; pistillate flowers, 2–3 on short axillary peduncles, sometimes forming short corymbiform spike; sepals 3, ovate, acute, somewhat connate at base, glabrous, 2 mm long; disk glands filiform; ovary hirsute; fruit ca. 4 mm in diameter, slightly reticulate, coarsely hairy; seeds elliptic, pitted, 1.5–2 mm long, brown. Fl. June, Fr. July.

Weedy places, fields. — European part: Lad.-Ilm., V.-Don (Kharkov), Bl. (Odessa), Crim.; Caucasus: W. Transc. Gen. distr.: S. and Centr. Eur., N. Africa. Described from Europe. Type in London.

Tribe 2. ACALYPHEAE Pax in E. P. Pflanzenfam. III, 5 (1896) 60. — Flowers apetalous and diskless; stamens 8–20; filaments free, anthers elongate, sometimes repeatedly twisted; ovary with 1 ovule in each cell.

Genus 855. **ACALYPHA*** L.

L. Sp. pl. (1753) 684

- 299 Monoecious, rarely dioecious plants; pistillate flowers in axils of broad bracts, staminate flowers in axils of small bracts on short thin spikes, pistillate and staminate flowers in common inflorescence; sepals 3–4(5), sometimes reduced in staminate flowers; ovary 3-locular; styles free, filiform, sometimes parted. Herbs (in the USSR), but mostly trees and shrubs.

About 250 species in the tropical countries.

* From the Greek *a* — without, *calos* — beautiful, pleasant, and *aphe* — touch, i.e., unpleasant to the touch.

1. Bracts ovate, acute, up to 20 mm long; cauline leaves lanceolate or ovate-lanceolate 1. *A. australis* L.
- + Bracts orbicular, up to 1.2 mm [?] long; cauline leaves acute, ovate or rhombic-ovate 2. *A. indica* L.

1. *A. australis* L. Sp. pl. (1753) 1004; Kom., Fl. Man'chzh. II, 684; Grossg., Fl. Kavk. III, 26. — *A. pauciflora* Hornem. in Herb. Hafn. II (1815) 909; Maxim. Prim. Fl. Amur. 240. — *A. genuina* Spreng. Syst. Veg. III (1826) 880.

Annuals, with thin root; stem erect, ribbed, strongly branching, coarse-hairy with hairs appressed above, 6–50 cm high; leaves alternate, with 1–4.5 cm long petioles, lanceolate or lanceolate-oval, acuminate, strongly crenate at margin, cuneate at base, glabrous or pubescent along nerves, 3-nerved at base. Inflorescence axillary, rarely terminal, on 0.5–6 cm long scapes, staminate and pistillate flowers in one inflorescence, staminate flowers in elongate thin spikes, 1–3 cm long, usually ending the inflorescence; staminate flowers in axils of small lanceolate bracts; sepals 4, very small thin coriaceous; filaments free, with 2 free hanging pollen sacs worn-like in shape; pistillate flowers in 3–5-flowered glomerules or spikelets, in axils of large, 1–2 cm long, foliaceous, hood-shaped bracts, crenate at margin; sepals ovate, acute, ciliate; ovary densely long hairy, 3(4)-locular; styles up to 3 mm long, dissected from base into 6–8 thin lobes; fruit coarse-hairy; seeds 1.5–2 mm long, ovate, smooth. Fl. July–August, Fr. August–September. (Plate XVII, Figure 6.)

Sandy soil and pebbles at riverbanks, clayey semi-exposed slopes, solitary and in groups, plowed land, building sites in habitation, weedy places. — Caucasus: as a weed among crops; Far East: Uss. Gen. distr.: Jap.-Ch. (Manchuria, Korea, N. China, Japan), America. Described from S. America. Type in London.

2. *A. indica* L. Sp. pl. (1753) 1003; Grossg., Fl. Kavk. III, 26. —

300 Annuals, ca. 0.5 m high, rarely taller; stem simple or slightly branching, often lignified at base, downy above; petioles 1.5–7 cm long, thin, downy, as long as blade or up to 1.5 times longer; leaves 2–6.5 cm long, 1.5–5 cm wide, ovate or ovate-rhombic, acute, cuneate or truncate-rounded at base, thin, at first downy nerves, later glabrous, dentate at margin, 5-nerved at base. Inflorescences axillary, rarely also terminal, solitary or in twos, bearing staminate and pistillate flowers, 1–7 cm long; spikelets of staminate flowers at end of inflorescence, on thin axis ca. 1 cm long, in some inflorescences staminate flowers absent; pistillate flowers 1–2 in axils of foliaceous suborbicular bracts, bracts 6–12 mm wide, dentate at margin, pubescent along nerves (3 to 7 bracts per inflorescence); sepals ovate, acute, ciliate, thin; ovary pubescent; styles short, partially divided; fruit short-hairy, 2 mm wide; seeds broadly ovate, obscurely punctate, up to 1.5 mm in diameter. Fl. July–September.

Weeds among crops. Records from the Caucasus (W. Transcaucasia) are probably incorrect since all the examined specimens determined as *A. indica* should be referred to *A. australis*. Gen. distr.: tropical countries of the Old World (India, S. Japan, China, Madagascar, Africa). Described from India. Type in London.

Genus★ **RICINUS*** L.**

L. Sp. pl. ed. 1 (1753) 1007

Flowers unisexual, monoecious; calyx 3–5-partite; petals absent; stamens numerous (more than one thousand), united in clusters, much branched above; ovary 3-locular, with 1 ovule in each cell; style 3-partite, with linear bright red stigmas; fruit a trivalvular capsule; seeds oval, with characteristic marble pattern. Annual (under cultivation) herbaceous plant or tree (in the tropics), with large palmately 7–11-sect leaves.

Three or four species of the genus growing wild in the tropics of the Old World. (Some authors separate the ornamental form into an independent species — *R. zanzibarensis* Hort.).

★**R. communis** L. sp. pl. ed. 1 (1753) 1007.

Annual (under cultivation) plants or shrubs; stems branching, 80–400 cm high, young branches and petioles with bluish bloom; leaves alternate, glabrous, large, petiolate, palmately 5–11-sect, lobes ovate-oblong, dentate at margin. Flowers unisexual, monoecious, in racemiform inflorescences
301 opposite leaves or terminal, the staminate flowers lower, the pistillate upper (sometimes irregularly disposed, sometimes in reverse order), often bisexual; perianth 3–5-partite; petals absent; stamens numerous, connate in clusters, branched above; anthers sometimes almost 1,000; ovary spherical-oval, 3-locular, with 1 ovule in each cell; style shortly 3-partite, with red linear stigmas, entire or 2-sect; capsules as large as a hazel-nut, globose-oval, covered with spines, 3-valvate, with 1 seed in each cell; seeds oval, different in size (depending upon the variety), varying from 0.8 to 2.5 cm long, with smooth shiny variegated testa and rather large aril.

Cultivated for its oil in the southern regions of the USSR, sometimes escaped. In the north it is often grown as an ornamental. — **Gen. distr.:** (cultivated): Med., Bal.-As. Min., Atl. Eur., Afr., S. Am., southern part of the U. S., tropical Asia. Described from India, Africa, and S. Europe. Type in London.

Note. The native habitat of *Ricinus* has not been precisely established, although Africa, in particular Ethiopia, may be rightfully considered as such. In the tropics and subtropics the genus is a perennial plant with a life cycle of 5–10 years. Its stem is dendroid, sometimes reaching a height of 10 m. In cultivation it is grown almost exclusively as an annual.

India is the main producer and exports the seeds to England and America. Brazil also exports the seeds, in addition to the oil.

Economic importance. The oil obtained from the seeds of *Ricinus* by means of hot and cold pressing is of considerable economic importance.

It is found as tiny globules in the cytoplasm. The term "castor" oil is derived from the scientific name of the beaver — *castor*. The beaver has been and still is fairly common in Canada. Refined castor-oil was at one time obtained from Canada whence, apparently, there originated the name castor oil, which is sometimes applied only to oil extracted by cold pressing; oil extracted by hot pressing is known simply as "*Ricinus*." The seed contains

* Treatment by B.K. Shishkin.

** From the Latin *ricinus* — mite; by their variegated coloration the seeds are reminiscent of mites (or the other way round).

46% fatty oil (in some varieties more than 60%), 20% starch, 2.5% resinous substances, and 0.5% protein. The specific weight of the oil is 0.961–0.973, and it is the most dense of all plant oils. The iodine number is 182–188. It freezes at -10° and dissolves in alcohol, ether, and glacial acetic acid. Its main component is triricinolein; there is very little stearin and no palmitin or olein.

Castor-oil differs from other plant oils by its solubility in alcohol, high acetyl index, and above-average density and viscosity. It should be added
302 that the oil is not soluble in petroleum, gasoline, does not affect rubber and in combustion leaves no trace.

Castor-oil is extracted by cold pressing under high pressure. It is then purified by boiling with water or processed by steam and filtered. The finished product is nearly colorless or a yellowish-green. The temperature affects the density of the oil very little and for this reason it is widely used for lubricating machines where the temperature changes are rapid. It is a virtually indispensable lubricant for motors and is also used in oiling delicate mechanisms such as watches, etc.

The oil is used in the manufacture of soap and in the tanning industry where it is used to preserve the flexibility of leather and its impermeability. It is also applied in the production of glycerine, rubber, and dyes in the textile industry. Castor-oil is known as a laxative throughout the world. It is often used, especially in India, in lamps, yielding a white, non-smoking flame.

The seeds contain poisonous substances that are insoluble in oil and do not pass over into it during cold pressing. Under hot pressing the oil contains poisonous substances. As food the seeds are extremely dangerous because of their toxicity and may even cause death (from 12.2 g of seeds).

The oil cakes obtained during the production of the oil are poisonous for cattle but are a good fertilizer since they contain up to 5% nitrogen and 1.5–1.6% phosphorous acid. For a period of 10–15 days cattle should be kept out of fields freshly manured with oil cakes.

Ricinus is widely cultivated in Europe (Italy, France, Spain, USSR), Africa (Algeria, Egypt, Sudan, Senegal, Madagascar), America (southern part of the USA, Brazil, Argentina), and in Asia (India, China, Iran). It was first cultivated in Italy in 1816. It was unknown in pre-revolutionary Russia, and experimental cultivation started only in 1914.

At present several hundred thousand hectares of land in the southern part of the USSR are occupied by *Ricinus*. In addition to *R. communis*, cultivation of *R. persicus* Pop. and *R. sanguineus* Host. is recommended. (Oil similar to castor-oil has been discovered in the seeds of *Wrightia annamensis* Dubart of the family Apocynaceae. The oil content is 36.1%.)

Ricinus is also grown as an ornamental plant because of its shape and variegated leaves.

Tribe 3. **JATHROPHEAE** Pax in E. P. Pflanzenfam. III, 5 (1896) 14, 72. —
303 Plant usually monoecious, flowers with or without petals, in cymose paniculate inflorescences; filaments free or connate; ovary 2–5-locular, with 1 ovule in each cell. Trees or shrubs, rarely herbs, many with milky juice.

Genus★ **ALEURITES** * Forst.**

Forst. Char. gen. (1776) 111.— Camirium Rumph. Herb. amboin. II (1742) 180

Monoecious or sometimes dioecious plants; flowers with petals, in cymose, loose, corymbiform or paniculiform inflorescences; calyx with 2–3-valvate lobes; petals 5; stamens 8–20 in 1–4 whorls one above the other on a convex receptacle; disk of 5 glands alternating petals, strongly reduced in pistillate flowers; rudimentary ovary absent in staminate flowers; fruit large, drupaceous, indehiscent, 2–5-locular, with 1 large seed in each cell. Low trees, with large entire or 3–5-lobed leaves.

Five to six species, distributed in the tropics and subtropics of SE Asia, the Philippines and Sulu Archipelago.

A. fordii Hemsl. in Hook. Icon. pl. XXIX (1906) tab. 2601, 2802; Pax in Engl. Pflanzenreich, IV, 147, 1 (1910) 132; Hutch. in Sargent, Pl. Wilson. II, 3 (1916) 528.— *A. cordata* Müll. Arg. in DC. Prodr. XV, 2 (1866) 724, p. p. non R. Br.— *Elaeococca verrucosa* Juss. Euph. tent. (1824) 38 (quoad fr. et sem.).— *Dryandra oleifera* Wall. (1832) Cat. No. 7958, nom. nud. non Lam.

Trees, 3–9 m high, with thick smooth branches covered with large light lenticels; leaves long-petioled, ovate or cordate, rounded-cordate or rounded-truncate at base, abruptly acuminate or short-mucronate, entire, coriaceous, dark green and shiny above, pale beneath, at first with appressed rufous hairs beneath, later glabrous, 7–15 cm long, leaves on sterile shoots, in young plants often 3-lobed, much larger, 25–45 cm long, very long-petioled. Inflorescences pedunculate, loose, paniculiform; pedicels as long as flowers, more or less covered with rufous hairs; pistillate flowers usually few, one at top of inflorescence; calyx usually 2-lobed, lobes ca. 1 cm long, obtuse, reddish-violet in lower part, more or less pubescent, membranous above; petals broadly ovate, white with pink tinge, with yellow spots at base, 25–30 mm long; glands thick, subulate, short; stamens 8–10
304 in 2 whorls; ovary (3)4-locular, with short 2-partite styles; fruit globose or turbinate, 4–5 cm long, short-mucronate, smooth, with fleshy exocarp and cartilaginous endocarp; seeds 2–2.5 cm long, ovate, laterally compressed, with hard, woody, more or less tuberculate testa. Fl. May, Fr. September.

Cultivated. — Caucasus: W. Transc. Grows wild and is widely cultivated in the Central and Southeastern provinces of China.

Economic importance. The seeds of *A. fordii* and of other species of this genus yield a rapidly drying, very valuable industrial oil used in the manufacture of varnishes. Up to 58.3% oil is extracted from the seeds of *A. fordii*. The high value of tung-oil makes *A. fordii* one of the basic subtropical cultivations in W. Transcaucasia (Abkhazia, Georgia, Adzharia). It has been sufficiently cold-resistant and withstood markedly low temperatures without any ill effects. It is therefore better than the related *A. cordata* (Thunb.) R. Br. which was introduced into cultivation in the Caucasus much earlier, but proved to be unsuitable being sensitive to low temperatures. *A. fordii* has modest edaphic requirements, easily adapted to rocky substrate. The seeds and fruits of tung are poisonous for both man and cattle (causing vomiting and diarrhea) and for this reason the oil-cakes are suitable only for manuring. It is a very ornamental plant.

* Treatment by A.I. Poyarkova.

** From the Greek — farinaceous.

Tribe 4. **EUPHORBIEAE** Pax in E. P. Pflanzenfam. III, 5 (1896) 102. — Plants usually monoecious, flowers rarely dentate [?], naked; staminate flowers with 1 stamen, the pistillate with 3-locular ovary, one ovule in each cell.

Genus 856. **EUPHORBIA*** L.**

L. Sp. pl. (1753) 450—463; Gen. pl. ed. 5 (1754) 208, No. 536

Plants monoecious, very rarely dioecious; flowers always apetalous and usually without sepals; staminate flowers always with 1 stamen, pistillate flowers with one 3-locular ovary, one ovule in each cell; cyathia long, flowerlike; involucre nearly regular, campanulate-turbinate or subglobose, composed of 5 (or 4, rarely 8) united leaves ending as lobes; 305 lobes scarious, entire or more or less incised, often overtopped by nectaries; nectaries [glands] 5 or 4, if abortive 3 or even 1, between lobes and alternating with them, spreading or slightly recurved, hardly stalked, entire, rounded or truncate at outer margin or crescent-shaped, more or less bicornute, sometimes pectinate or palmatipartite at margin, sometimes with petaloid appendage below; axis of peduncle in the center of cyathium terminating in a solitary pistillate flower with pedicel protruding from involucre elongating and drooping; circles of numerous staminate flowers, whorled, usually with more or less developed, linear or subulate, fimbriate-ciliate bracts or rarely ebracteate below, in axils of leaves of cyathium (opposite lobes).

Staminate flowers (5)10—40(50), without sepals, pedicel [stamen] articulate beneath, very rarely with small scale at joint; anthers erect, with parted cells opening by longitudinal slits; pistillate flowers naked, sometimes with calyx of 3(6) small scales; styles 3, free or more or less connate, entire or 2-fid, with dilated capitate stigmas at tip or inside. Fruit schizocarp [capsule], smooth or tuberculate, 3-valved or tricoccous, separating into 3 1-seeded nuts (pericarp soon splitting into 2 valves) and with trihedral column remaining in middle of receptacle; endocarp membranous or hard (in one case — *E. lathyris* — mesocarp spongy); seeds smooth or uneven at surface, with appendage (aril) or without, endosperm hard or scarious, embryo erect, cotyledons broad, flat.

Perennial or annual herbs or shrubs, variable in habit, prostrate or erect; stems sometimes thick-fleshy or nearly leafless. Latex vessels inarticulate, profuse, rich in acrid, poisonous milky juice or latex. Leaves simple, entire or rarely more or less crenate, exstipulate or with interpetiolar stipules. Characterized by the developmental change at onset of flowering; at first a more or less prolonged monopodial growth, then a sympodial growth and the development of more or less compound cymose inflorescences.

In simple cases, monopodial growth (*E. sclerocyathium*, *E. monocyathium* and others) is completed by the formation of solitary cyathium. The growth continues with the lateral branches.

* Treatment by Ya. I. Prokhanov.

** Pliny's name for the plant after the court physician of Juba, ruler of Mauretania.

In a typical case (in most Russian *Euphorbia*) there are two stages of development: the vegetative-monopodial and the reproductive-sympodial. At first, stems are developed from the rootstock or root-collar, the stems are monopodial, more or less densely leafy, with alternate leaves, sometimes partly opposite below and only in very rare cases (*E. lathyris*) along the entire stem. Afterwards, in accordance with the degree of transition to the sympodial, flowering stage, the growth of the shoots slows down, the leaves form a whorl or are opposite and this culminates in the formation of a terminal cyathium with whorls or regular involucre of approximate, apical leaves (leaves of involucre) beneath the cyathium.

Subsequent sympodial growth is evidenced in the development of 3 (rarely 2) or more terminal peduncles from the axils of the involucral leaves, altogether forming cymose umbels (pleiochasia), which often combine also axillary peduncles emerging from the axils of the upper cauline leaves.

This sympodial growth is naturally interrupted by the formation of inflorescences-cyathia- at the top of the peduncles, with their involucels composed of whorled (3 or 4 each) or opposite (2) leaves (leaves of involucels). However, a new rapid growth occurs with the development from the axils of the involucel leaves of a small bundle of 2-3(4) secondary peduncles, thus the growth is ended by a terminal cyathium with a 2-3-leaved involucel. By this way of periodical cessation in growth and the subsequent growth of axes of the next orders, the cymose inflorescences (cymose umbel or rarely dichasial cyme) become very complex.

Thus the primary peduncles of the pleiochasium either terminate as forked cymes (dichasia) with 2-leaved involucels and 2 derivative peduncles (spurious dichotomous branching) or as secondary cymose umbels (pleiochasa) with 3-(4)-leaved involucels and 3(4) peduncles which often, however, are subsequently branched, developing in common, forked cymes, with 2-leaved involucels.

Sometimes (especially in *E. seguieriana*, *E. stricta* and others) the terminal forked cyme (dichasium) may become a monochasium because of the incompleteness of one of its two rays, and thus it resembles a monopodial shoot but with all leaves opposite.

Such sympodial branching, if it happens for a prolonged period, may lead to the formation of a compound cymose inflorescence, and to the decrease of the preceding monopodial branching, thereby markedly reducing the original, true (monopodial) leafy shoots. This is obvious in *E. iberiensis*, *E. turczaninovii* and other annuals of Boissier's subsection *Oppositifoliae*.

An extreme case (according to Croiza) is represented by the species of the subgenus *Chamaesyce*. Here, the monopodial branching is completely suppressed and the sympodial branching starts at the very beginning, developing into cymose inflorescences without stems, and finally forming pseudodichotomous forked cymes; this is typical of the Russian species.

There are about 800 species in *Euphorbia* L., 159 of which are found in the USSR. Most of them are common to hot, subtropical places under arid and coastal conditions and are distinct thermophytes or xerophytes. There are only a few species that penetrate into the tropical zone proper and very few into the cold belt.

Fossils of *Euphorbia* may be found only as fruits and seeds. Only one has been discovered so far.

Euphorbia sp. in Mio-Pliocene deposits of Ob (Kireevskoe east of Tomsk); in Miocene deposits of V.-Kama (Solikamsk).

Economic importance. Although some of the exotic species (*E. th* Schw.) proved to be excellent rubber-yielding plants, the Russian spurges of the subgenus *Paralias* did not contain a sufficient quantity of rubber in their latex but yielded mainly resin. For this reason the interest in them as possible rubber-yielding plants has naturally decreased.

However, owing to the copious resin contained in spurge, especially in the nonrubber yielding species of subsection *Myrsiniteae* (*E. biglandulosa*), they are of interest as resiniferous plants.

In general, the economic importance of spurge in the USSR is not significant.

The spurge undoubtedly is unfavorable because it is a pungent and poisonous plant, dangerous to cattle, not so much in pasturelands where the animals avoid it, but in hay where it is harmful. Some species, *E. pallasii* in Siberia in particular, are well known as poisonous plants.

Note. The author of the given treatment was convinced at first of the need to split *Euphorbia* L. into smaller genera as other authors had done. At present, the author does not consider this viewpoint as absolutely obligatory, even if it might be the right one for such a polymorphic genus as *Euphorbia* L. However, alternative names of minor genera that are components of *Euphorbia* L. are presented. Due to the difficulty in defining the smaller separate genera and the occurrence of one morphological series, from monopodial to sympodial, in *Euphorbia* L. it is preferable to maintain *Euphorbia* L. as a single genus, extensive but sufficiently natural.

The intrageneric units (subgenera, sections and subsections) proposed here are more or less arranged in the order of this biological-morphological series.

In our preliminary system of the Russian species of *Euphorbia* L. and the key to their determination, the following were considered to be significant characters in many of the species: length of the stem, and especially, as previous authors had noted, the number of derivative peduncles in the nodes of the cymose umbels and similarly in the nodes of the axillary peduncles, i. e., two or three.

In general, for the determination of the species of *Euphorbia* one must have mature schizocarps with available seeds; without the seeds it is impossible to identify the different annual species since this is often done by the seeds alone. In addition, the following characters are essential in order to distinguish the taxa of *Euphorbia*: the branching number (2 or 3) of the primary peduncles, as mentioned above; the number, form and possible pubescence of the leaves of the uppermost involucre; the number of nectaries (5 when complete, 4 or less when incomplete due to falling); the presence or absence of a calyx in the pistillate flowers; the length of the style; the presence of nonflowering branches. All other characters, such as the shape of the cauline leaves and the disposition of peduncles in the cymose umbels, regardless of how striking they may appear, are without any significant importance because of their inconstancy. This inconstancy sometimes makes it difficult to distinguish the species of *Euphorbia* L.

The genus *Euphorbia* is not represented in the USSR by series of vicarious species, thus only in a few cases were we able to separate series of vicarious species; otherwise we confined ourselves to establishing subsections. This concerns not only annuals, in which vicariousness is generally weak, but also perennials.

Key to Subgenera

1. True (monopodial) stem more or less developed, usually (at least partly) with alternate leaves, bearing above cymose inflorescence, with 2–3-leaved involuclers; leaves exstipulate; nectaries 5 or 4 (in the latter case with 1 absent), entire or bicornute or even pectinate, without petaloid appendages beneath Subgenus 1. *Paralias* (Rafin.) Prokh. ampl.
- + True (monopodial) stem absent; plants consisting of forked cymose inflorescences, with opposite (or even whorled)* leaves in nodes; leaves always stipulate; nectaries (in Russian species) always 4 (1 absent), with petaloid appendages or without 2.
2. Nectaries palmatipartite, without petaloid appendages beneath; seeds with 2 vesiculaeform longitudinal appendages below Subgenus 2. *Cystidospermum* Prokh.
- + Nectaries usually entire, with more or less developed petaloid appendages below; seeds (in Russian species) without appendages Subgenus 3. *Chamaesyce* (S. F. Gray).

Subgenus 1. *Paralias* (Rafin.) Prokh. comb. nova. — Generis *Tithymali* subgen. *Paralias* Rafin. Fl. tell. (1838) 115, ampl. — *Tithymalus* Tourn. ex Scop. Fl. carn. ed. 2, I (1772) 322, non *Tithymalus* Mill. (1754), neque Haw. (1812); Neck. Elem. II, 354; Lam. Fl. Fr. III, 88; Rafin. Fl. tell. IV, 115; Klotzsch, in Monatsb. Akad. Berl. (1859), 251–252; Britt. and Brown, Fl. north. U. S. Can. II, 471; Prokh. in Izv. Glavn. Bot. Sada SSSR. XXIX, 551–559; Obz. moloch. Sr. Azii, 33. — *Keraselma* Neck. Elem. II (1790) 353; Rafin. l. c. 116. — *Galarhoeus* Haw. Syn. pl. succ. (1812) 143; S. F. Gray, Nat. Arr. Brit. Pl. II, 256; Fourr. in Ann. Soc. Linn. Lyon, N. S. XVII, 149; Rydberg in Brittonia, I, 92; Prokh. in Trud. Kuibysh. Bot. Sada, I, 9. — *Esula* Haw. l. c. 153; S. F. Gray, l. c. 257; Fourr. l. c. 149. — *Sektsiya Tithymalus* Boiss. in DC. Prodr. XV, 2 (1862) 99–175; Fl. or. IV, 1091–1137; Prokh. in Izv. Akad. Nauk SSSR. (1927) 197–212; Kryl., Fl. Zap. Sib. VIII, 1864–1882. — For characteristics of the subgenus, see Key.

The dendroid species of the subgenus *Paralias* (or the genus *Tithymalus*) which are concentrated in the Canary Islands should be regarded, as in all similar cases, as the more primitive ones. One species (*E. dendroides*), being the type of the genus *Tithymalus*, occurs in the Mediterranean area. The more developed are unquestionably the annual forms which produce seeds of a unique structure and often without appendages.

* According to Croiza the interpetiolar stipules in some species represent abortive leaf whorls and are additional to 2 well-developed opposite leaves.

Note. The candelabrum, cactuslike spurge was considered to be the basis of the genus *Euphorbia* L., and the cactuslike *E. anti-quorum* L. has been the lectotype of the genus. If *Euphorbia* L. is to be divided into smaller genera, as the author earlier intended to do, then many of the Russian species which do not answer to that type should be excluded from this genus. For nearly two centuries the generic name *Tithymalus* was invariably applied in these Russian taxa. This was the treatment by Scopolia, Nekker, Lamarck, Rafinesque, Klotzsch and Garcke. Only twice was it interpreted otherwise: in 1754 by Miller and in 1812 by Hauert. Rydberg's proposition, that due to priority *Tithymalus* should be recognized in Miller's sense and Russian spurge be given the name *Galarhoeus* instead, cannot be accepted for the following reasons:

Miller's name, dated 1754, did not emerge in the basic year of the nomenclature of genera (1754), yet it appeared in a work that was not applied to the binary nomenclature and subsequently included in the list of banned books at the Sixth Amsterdam Congress. Because of the war approval of this list of banned books could not take place at the next Congress and the question remained formally open.

However, even in this case, Miller's conception of *Tithymalus sensu Pedilanthus* Neck. is unacceptable because the latter name in the division of *Tithymalus* was almost invariably applied to our common Russian spurge; Article 21 in the rules of nomenclature is referred to such
 310 generic names in common use for over 50 years, recommending their conservation in spite of priority. Consequently, although the list of banned books was never confirmed, *Tithymalus* (when separated from the genus *Euphorbia*) should be included in the *nomina generica conservanda*.

Unfortunately, according to the rules of nomenclature, the Russian subgenus corresponding to *Tithymalus* must be called subgenus *Paralias* and not *Tithymalus*. Only when this subgenus is ranked as a separate genus, could it again receive its former, naturally acceptable generic name of *Tithymalus*.

1. Schizocarp globulose with fleshy pericarp, not splitting; cauline leaves all opposite; tall annuals (section *Epurga*); nectaries with 2 spatulate horns 148. *E. lathyris* L.
- + Schizocarp more or less trisulcate, with dry pericarp breaking into nutlike cocci; cauline leaves (at least of the nonflowering stems) alternate, sometimes few 2.
2. Styles free, entire; leaves pinnately veined, veins spreading into teeth; petioles longer than 5 mm, distinct from leaves; nectaries palmatipartite (section *Demetra*). Tomentose-villous annuals, with short stem and broadly branching inflorescence 147. *E. lanata* Spreng.
- + Styles more or less 2-lobed above, usually connate at base; leaves palmately or pinnately veined, lateral veins not reaching margin; petioles usually inconspicuous 3.
3. Nectaries transversely elliptic or reniform, with margin more or less uniformly convex outside, hornless, edentulate; peduncles 2- or 3-branched or cyathia solitary at top of shoots; involucels of 2 or 3 leaves; schizocarp smooth or with developed appendages . . . 4.

- + Nectaries crescent-shaped, mostly bicornute, with margin notched outside or pectinate-dentate or if hornless then truncate; peduncles 2-branched; cyathia never solitary; involucels of 2 leaves; cocci smooth or only faintly rugose-tuberculate, without noticeable processes 61.
4. Cauline leaves distinctly shorter than internodes; cyathia usually solitary at top of leafy shoots; involucels of 2 leaves; nectaries 5, orbicular, hornless; cocci smooth (section *Sclerocyathium*) 1. *E. sclerocyathium* E. Kor. et M. Pop.
- + Cauline leaves not shorter than internodes; herbs, rarely semishrubs 5.
- 311 5. Seeds mostly brown, smooth or sometimes reticular-rugose or reticular-pitted; schizocarp not conical, with processes or smooth; peduncles 2- or 3-branched; involucels 2- or 3-leaved; plants glabrous or more or less pubescent 6.
- + Seeds greenish-white or whitish-gray, smooth or sparingly finely pitted; schizocarp more or less conical, smooth (even in furrows), only rarely tuberculate, with soft pericarp; peduncles 2-branched; involucels 2-leaved; glabrous plants 56.
6. Seeds reticular-pitted, flattened at tip, obtuse, with vertical scalelike appendage; cauline leaves cuneate at base, spatulate, dentate-crenate at the obtuse apex; schizocarp deeply trisulcate, smooth (even in furrows), with soft pericarp (subsection *Helioscopiae* Prokh.). Nectaries greenish; yellowish, annual plants 52. *E. helioscopia* L.
- + Seeds smooth, only sometimes reticular-rugose, obliquely truncate at tip, with more or less oblique appendage; cauline leaves more or less tapering, entire or finely serrate; schizocarp with processes or if nearly smooth then rugose furrowed, with more or less hard pericarp; perennials or annuals 7.
7. Schizocarp without processes, but often more or less rugose, especially along furrows; cyathium broadly campanulate, with large lobes, usually pubescent; nectaries 4, reniform, dark; leaves entire, obtuse, pubescent at margin, rarely glabrous; plants more or less purple above, with thick root or tuber (section *Holophyllum* Prokh.) 8.
- + Schizocarp with processes, rarely nearly smooth, inconspicuously tubercled, pericarp more or less hard; nectaries transversely elliptic, dark or light; leaves finely serrate, especially at apex, rarely entire, obtuse or acute; plants purple or yellowish above, often with thick root, but never with tuber (section *Tulocarpa* (Rafin.) Prokh.) 20.
8. Stems simple, floriferous or not, without axillary peduncles; schizocarp with usually slightly ascending style, pericarp hard; plants sometimes with more or less thick rhizome, but never with tuber (series *Rupestres*) 9.
- + Stems all floriferous, with axillary peduncles, sometimes with sterile branches; schizocarp somewhat obtuse; plants usually with tuber (series *Blepharophyllae*) 17.

9. Leaves of involucels longer than wide, 2; peduncles simple or cyathia solitary; cauline leaves alternate, sometimes approximate nearly in a whorl but not whorled 10.
- 312 + Leaves of involucels generally shorter than wide, the upper 2, the lower 2 or 3; peduncles 2-branched, very rarely simple; cauline leaves alternate or all or only the upper whorled 12.
10. Cauline leaves inconspicuous, nearly scalelike, only the upper and leaves of involucre developed, tapering at base; schizocarps on conspicuous stalks; stems few, often creeping at base 4. *E. rosularis* A. Theod.
- + Cauline leaves developed, usually dilated at base, rounded or somewhat attenuate; schizocarps on short stalk, with its base often within the involucre; stems generally numerous, erect or prostrate 11.
11. Cauline leaves about three times longer than wide (more than 2 cm long); peduncles 5; styles 3–4 mm long; stems erect, 10–40 cm high, curly-hairy above, rarely glabrous 2. *E. serawschanica* Rgl.
- + Cauline leaves approximately twice as long as broad (shorter than 2.3 cm); peduncles simple, solitary, rarely 2–3; styles 1.5–2.5 mm long; stems ascending or prostrate, 6–15 cm high, glabrous 3. *E. monocyathium* Prokh.
12. Peduncles 2-branched or rarely simple, involucels always 2-leaved; cauline leaves regularly alternate 13.
- + Peduncles 3-branched, only later 2-branched; upper involucels 2-leaved, the lower often 3-leaved; all leaves of floriferous stems, or only the upper (under involucre) whorled, more or less crowded on lower part of stem 14.
13. Cauline leaves cordate at base, about $1\frac{1}{2}$ times longer than wide; peduncles 2-branched; cyathium more or less pubescent; schizocarp and seeds relatively large; seeds with short-stalked appendage 5. *E. tianshanica* Prokh.
- + Cauline leaves short-cuneate at base, 2 to 3 times longer than wide; peduncles simple; cyathium glabrous outside; schizocarp not as large above; seeds slightly smaller, with sessile appendage 6. *E. prokhanovii* M. Pop.
14. Leaves of floriferous stems crowded at base, long cuneate at base, widest in upper part; peduncles 3–5, usually 2-branched; schizocarp glabrous 7. *E. rupestris* Ldb.
- + Leaves of floriferous stems all or only upper ones in whorls, rounded or slightly attenuate at base, widest below middle; peduncles 5, 3-branched, involucels of 3 leaves, later peduncles 2-branched and involucels 2-leaved; schizocarp glabrous or pubescent 15.
- 313 15. Cauline leaves flat, the upper on the floriferous stems often ovate-rhombic, usually in 1 whorl, rarely only quite approximate; peduncles suberect; schizocarp 5–6 mm long; glaucous plants 8. *E. mongolica* Prokh.
- + Cauline leaves more or less incurved at margin, those of floriferous stems oblong or elliptic, usually in few whorls; peduncles spreading post anthesis; schizocarp 6–7 mm long; plants not glaucous 16.

16. Styles 3–4 mm long; cyathium hairy inside, lobes ciliate at margin; peduncles (up to dichasium) not longer than 7.5 cm, not elongating 9. *E. pallasii* Turcz.
+ Styles 1.5–2 mm long; cyathium glabrous, lobes not ciliate; peduncles elongating in fruit and reaching (up to dichasium) 5–13 cm 10. *E. komaroviana* Prokh.
17. Stems glabrous, not contracted below, nonflowering branches absent; peduncles 2- or 3-branched; leaves of involucl up to two times as long as wide; schizocarp with soft pericarp, usually longer than wide 18.
+ Stems villous, contracted below, bearing nonflowering branches often exceeding inflorescence; peduncles 3–5-branched, later sometimes in addition 2-(3)-branched; leaves of involucl usually slightly shorter than wide; schizocarp with hard pericarp, usually shorter than wide 19.
18. Peduncles 2-branched, the terminal ones 2–3, inconspicuous, the axillary rather numerous, nearly spreading; involucl 2-leaved; cauline leaves oblong, usually glabrous, tapering at base 11. *E. rapulum* Kar. et Kir.
+ Peduncles 3-branched, the terminal 5, conspicuous, the axillary few, ascending; lower involucl 3-leaved; cauline leaves broadly ovate, ciliate at margin, cordate at base 12. *E. blepharophylla* Ldb.
19. Cauline leaves usually longer than 5 cm and wider than 2.5 cm, sparingly ciliate at margin; leaves of upper involucl approximately equal in length and width, not overlapping at base; schizocarp 9–10 mm wide 13. *E. ferganensis* B. Fedtsch.
+ Cauline leaves not longer than 5 cm nor wider than 2.5 cm, densely ciliate at margin, scarious; leaves of upper involucl usually slightly wider than long, overlapping at base; schizocarp 6–7 mm wide 14. *E. lipskyi* Prokh.
20. Leaves of all involucl sparingly villous; villous annuals or at least flowering in the first year, with thin root 24.
- 314 + Leaves of involucl glabrous except sometimes for the lowermost; annuals or often perennials 22.
21. Plants higher than 25 cm; stems usually branching at base, $\frac{1}{2}$ or more of total plant length; terminal peduncles 5, at first 3-branched, later up to 3 times 2-branched; leaves of lower involucl 3, of the others 2; styles up to 1.5 mm; schizocarp with short processes; seeds compressed-ovate, slightly tuberculate, with appendage 41. *E. pubescens* Vahl.
+ Plants up to 25 cm high; stems simple, approximately $\frac{1}{3}$ of total length of plant; terminal peduncles 3(4), many times (3–7 times) 2-branched; leaves of involucl 2; styles longer than 1.5 mm; schizocarp without processes; seeds globular, smooth, without appendage 51. *E. eriophora* Boiss.
22. Perennials, with root more or less thick; peduncles not more than 3 times branched; cyathium more than 2 mm in diameter 23.
+ Annuals, with thin root; peduncles branching more than 3 times, several times 2-branched, at end (in nodes) often with only solitary derivative peduncles; cyathium less than 2 mm in diameter ... 53.

23. Styles longer than 2 mm, connate for $\frac{1}{3}$ to $\frac{1}{2}$ of their length, shortly 2-lobed at apex; schizocarp more than 5 mm wide; leaves of involu-
cel often yellowish 24.
+ Styles usually up to 2 mm, if slightly longer than nearly free; leaves
of involu- cel yellowish or reddish 30.
24. Schizocarp with short compressed-conical appendages, about 5 mm
long; styles usually 4 mm long or longer; cauline leaves thick,
lanceolate, entire; leaves of lower involucels usually 4; tall, glab-
rous plants 21. *E. orientalis* L.
+ Schizocarp with long (more than 1.5 mm) curly, filiform-cylindrical
processes; styles rarely longer than 4 mm; leaves of involucels
3 or 2 25.
25. Peduncles simple, usually not longer than 1 cm; leaves of involucels
2, distinctly longer than wide; seeds irregularly reticular-rugose;
stems simple; glabrous plants 15. *E. scripta* Somm. et Lev.
+ Peduncles simple or branching, longer than 1 cm; seeds usually
smooth 26.
26. Leaves of involucels obtuse; plants usually higher than 30 cm . . 27.
+ Leaves of involucels acute or cuspidate; peduncles simple; plants
usually shorter than 30 cm 29.
27. Leaves of involucels 3, about as long as wide; leaves entire
. 18. *E. transoxana* Prokh.
- 315 + Leaves of involucels 2, the upper wider than long 28.
28. Cauline leaves not cordate at base, usually wider than 1.8 cm, with
petioles 2 mm long or longer; peduncles 2 to 3 times 2-branched;
schizocarp ca. 5 mm long, easily separated; plants 40–80 cm high . .
. 16. *E. squamosa* Willd.
+ Cauline leaves sessile, cordate at base, not wider than 1.8 cm;
peduncles simple or once 2-branched; schizocarp ca. 10 mm long;
plants lower than 45 cm 17. *E. macrocarpa* Boiss. et Buhse.
29. Schizocarp glabrous; cauline leaves widest above middle (more than
4 mm); leaves of involu- cel 2, length equaling width, cuspidate; stems
with short, nonflowering branches; glabrous plants
. 19. *E. mucronulata* Prokh.
+ Schizocarp curly-hairy and downy; cauline leaves widest below
middle (not wider than 4 mm), about 10 times longer than wide;
leaves of involucels distinctly longer than wide; stems simple;
curly-hairy and downy plants . . 20. *E. kudrjashevii* (Pazij) Prokh.
30. Leaves of all involucels, or at least of the lower, 3 or 4, if 2 then
styles connate for less than $\frac{1}{3}$; peduncles simple or at end (i. e.,
in first dichasium) 3–4-branched 31.
+ Leaves of all involucels 2; styles nearly free, 2-sect; peduncles
simple or at end (i. e., in first dichasium) 2-branched 45.
31. Stems appressed-tomentose; schizocarp usually slightly longer than
wide, nearly not furrowed, with filiform-cylindrical appendages
(1–2 mm); terminal peduncles short, inconspicuous among the
numerous axillary peduncles 39. *E. macrorrhiza* Ldb.
+ Stems more or less spreading-hairy or glabrous; schizocarp as
long as wide or shorter 32.

32. Cyathium incised for half its length, with very large lobes, glabrous; nectaries usually only 3; schizocarp with curly filiform processes (1–2 mm long); styles 0.5–1 mm long; peduncles 3-branched, later 2-branched, terminal (sometimes one axillary) 32. *E. polychroma* Kern.
- + Cyathium incised for less than half its length, lobes not particularly large; nectaries 4; schizocarp with straight processes or nearly smooth 33.
33. Styles connate at least for $\frac{1}{3}$, thickly 2-lobed at apex, more than 1 mm long; terminal peduncles short, inconspicuous among the more numerous, more developed axillary peduncles, often reaching their level; leaves of involuclers yellowish, approximately $1\frac{1}{2}$ times longer than wide; cyathium lanate inside; rather tall plants 34.
- 316 + Styles hardly connate at base or free; terminal peduncles elongate, distinct, forming a cymose umbel over the few, longer axillary peduncles; leaves of involucler yellowish or purple 43.
34. Schizocarp with dark red subulate processes (1.5–2.5 mm long); styles 1–1.5 mm; stems not branching, densely white-villous above; cauline leaves usually obtuse 31. *E. pilosa* L.
- + Schizocarp with short tuberculate or comblike colorless processes or nearly smooth and only sparsely tubercled; stems usually with nonflowering leafy branches below peduncles, often exceeding inflorescence, glabrous or sparingly pubescent 35.
35. Cauline leaves oblong or obovate, obtuse, entire; schizocarp glabrous sometimes with tuberculate or comblike processes; plants glabrous 36.
- + Cauline leaves lanceolate or oblanceolate, more or less acuminate (especially those on branches), finely serrate; schizocarp slightly rugose-furrowed, with few small processes or often nearly smooth, sometimes more or less long-ciliate; plants glabrous or pubescent 37.
36. Schizocarp 4.5–5 mm long, 6–7 mm wide, with tuberculate processes on cocci; cyathium 3.5–4.5 mm in diameter; peduncles (at first dichasium) 3- or 4-branched; cauline leaves, except for the lower, up to 3 times as long as wide; plants taller than 60 cm 22. *E. palustris* L.
- + Schizocarp 3–3.5 mm long, 3.5–4.5 mm wide, with comblike processes in upper part of cocci; cyathium 2–2.5 mm in diameter; peduncles (at first dichasium) 3- or 2-branched; cauline leaves 3 times as long as wide; lower plants, up to 65 cm 23. *E. eugeniae* Prokh.
37. Cauline leaves up to 4 times as long as wide, spreading-hairy especially at margin and beneath along nerves; stems dark, usually glabrous; schizocarp with long white spreading hairs 38.
- + Cauline leaves 4 times longer than wide; schizocarp glabrous or only sparsely hairy 39.
38. Leaves of involuclers $1\frac{1}{2}$ to 2 times longer than wide; cauline leaves usually dilated above the middle, $2\frac{1}{2}$ to 4 times longer than wide; plants 45–170 cm high 24. *E. carpatica* Włoszcz.

- 317 + Leaves of involucels as long as wide or slightly longer; cauline leaves usually dilated at the middle, 2 to 3 times longer than wide; plants 30–80 cm high 25. *E. tauricola* Prokh.
39. Cauline leaves rounded or cordate at base, widest at the middle or below, pubescent at least at base, upper leaves obtuse or acute. 40.
- + Cauline leaves cuneate at base, widest above middle, glabrous, upper leaves acuminate; stems glabrous 41.
40. Stems more or less villous; cauline leaves oblong-lanceolate, 9–25 mm wide, rounded at base 26. *E. villosa* W. et K.
- + Stems glabrous or subglabrous; cauline leaves rounded or cordate at base, lanceolate or sublinear, 6–20 mm wide 27. *E. semivillosa* Prokh.
41. Cauline leaves 10–16 mm wide, with mucro longer than 1 mm; schizocarp nearly smooth, sometimes indistinctly and sparingly tubercled; styles 1.5–2.5 mm long 28. *E. aristata* Schmalh.
- + Cauline leaves 5–22 mm wide, with mucro not longer than 0.5 mm; styles 1–2(2.5) mm long 42.
42. Schizocarp sparsely and finely tuberculate when mature 29. *E. soongarica* Boiss.
- + Schizocarp nearly smooth when mature 30. *E. lamprocarpa* Prokh.
43. Cauline leaves cordate at base, widest above middle; leaves of involucels approximately $1\frac{1}{2}$ times longer than wide, more or less yellowish, lower leaves 3 unequal in size, upper leaves 2; cyathium lanate inside; styles 0.5–1 mm long; glabrous plants 40. *E. buchtormensis* Ldb.
- + Cauline leaves not cordate at base, at least upper leaves widest below middle; leaves of involucels approximately as long as wide, more or less purple; styles not shorter than 1 mm; plants more or less . . . pubescent or glabrous 44.
44. Styles not longer than 1.5 mm; schizocarp with short tubercles; cyathium glabrous; peduncles usually simple, short (up to 3.5 cm); cauline leaves dilated below middle (not more than $2\frac{1}{2}$ times longer than wide). 42. *E. alatavica* Boiss.
- + Styles longer than 1.5 mm; schizocarp with comblike processes; cyathium slightly hairy inside; peduncles long (more than 2.5 cm), 3-branched, later 2-branched; cauline leaves, except for the upper, usually with subparallel margins, more than $2\frac{1}{2}$ times longer than wide 43. *E. lucorum* Rupr.
- 318 45. Cauline leaves dilated at base, cordate-amplexicaul; terminal peduncles inconspicuous, axillary peduncles many; leaves of involucels $1\frac{1}{2}$ to 2 times wider than long, obtuse, often more or less purple; nectaries 5; glabrous plants, with subglobose tuber 44. *E. condylocarpa* M. B.
- + Cauline leaves not amplexicaul or cordate; leaves of involucels distinctly longer than wide or about as long or rarely very slightly shorter than wide; plants without characteristic tuber 46.
46. Cyathium on stalk not shorter than 5 mm; nectaries 5; styles longer than 1.5 mm; leaves of involucels more or less cuneate at base,

- 1½ times longer than wide, usually yellowish; terminal peduncles (3)5, drooping at anthesis; cauline leaves petioled, entire; stems winged-ribbed, not bearing nonflowering branches; rhizome horizontal, nodose-jointed 33. *E. carniolica* Jacq.
- + Cyathium obsoletely stalked; styles not longer than 1.5 mm; leaves of involucels usually rounded at base; peduncles not drooping; cauline leaves subsessile, usually crenate (sometimes obscurely so) 47.
47. Leaves of involucels more or less purple or green at anthesis, slightly or 1½ to 2 times longer than wide; all parts of plant or only nectaries often purple. 48.
- + Leaves of involucels yellowish at anthesis, about as long as wide; leaves of involucre ovate-rhombic, distinctly shorter than peduncles; nectaries 4; stems simple 52.
48. Schizocarp nearly smooth; stigmas sessile, without styles; nectaries 5; stems many, lignified at base, densely leafy, with short nonflowering branches; leaves of branches 5 to 6 times longer than wide 45. *E. wittmanni* Boiss.
- + Schizocarp with distinct processes; styles 1–1.5 mm long; nectaries 4; cauline leaves not more than 4 times longer than wide 49.
49. Terminal peduncles few, inconspicuous, axillary peduncles numerous; cauline leaves cordate at base, usually with parallel margins (up to twice as long as wide), truncate or even slightly notched at apex; leaves of involucels up to 1½ times longer than wide 38. *E. alpina* Ldb.
- + Terminal peduncles distinct, forming a cymose umbel; cauline leaves not cordate at base (usually more than twice as long as wide), obtuse, not truncate; leaves of involucels more than 1½ times longer than wide 50.
50. Cauline leaves obovate, cuneate at base; leaves of involucre shorter than peduncles, leaves of involucels generally orbicular-elliptic; schizocarp more or less oblong, with reddish comblike processes; stems virgate, usually bearing nonflowering branches, long persistent; cespitose semishrubs 46. *E. pachyrrhiza* Kar. et Kir.
- + Cauline leaves rounded at base; leaves of involucres longer or rarely somewhat shorter than peduncles; leaves of involucels dilated and rounded at base; schizocarp flattened-globular, with short tuberclelike processes 51.
51. Cauline leaves shorter than 3.8 cm, 2 to 3 times longer than wide, glabrous; axillary peduncles solitary or absent; cyathium hairy inside; schizocarp 4–5 mm long, ca. 5 mm wide; stems many, long persistent; rhizome abortive but root thick 47. *E. talastavica* Prokh.
- + Cauline leaves usually longer than 3.5 cm, 3 to 4 times longer than wide, usually spreading-hairy and paler beneath; axillary peduncles 3 or more; cyathium glabrous inside; schizocarp ca. 3 mm long, 3.5–4 mm wide; stems solitary or 2; rhizome horizontal, consisting of thickened sections 48. *E. dulcis* L. em. Jacq.
52. Cauline leaves 4–7, slightly tapering or rounded at base; stems acutely ribbed; leaves of involucels as long as wide or slightly shorter; cyathium hairy inside; styles not longer than 1 mm;

- rhizome consisting of alternate-long thin sections and small tuberous joints, usually not branching 49. *E. angulata* Jacq.
- + Cauline leaves 5–11, at least the upper cuneate at base; leaves of involucl as long as wide or slightly longer; cyathium glabrous inside; styles longer than 1 mm; rhizome knobby, cordlike but not jointed, dark, branching 50. *E. altaica* Ldb.
53. Seeds not compressed, with powdery bloom, without appendages; schizocarp with comblike biseriate processes in upper part; cyathium glabrous; leaves of involucl approximately 2 times longer than wide; cauline leaves cuneate at base; inflorescence longer than stem; plants not higher than 14 cm
- 37. *E. coniosperma* Boiss. et Buhse.
- + Seeds slightly compressed, without bloom, appendaged; schizocarp with erect processes or sometimes nearly smooth; cyathium hairy inside; leaves of terminal involucl usually shorter than wide; cauline leaves not cuneate at base; inflorescence shorter than supporting stem; plants higher than 15 cm 54.
54. Schizocarp 1.8–2 mm long, 2–2.5 mm wide, distinctly trisulcate, with conoidal processes on cocci; seeds ca. 1.5 mm long, 1–1.2 mm wide; cauline leaves pale green, scarious 34. *E. stricta* L.
- 320 + Schizocarp 2.5–3 mm long, 3–3.5 mm wide, obscurely trisulcate, without processes, at least along midrib of cocci; seeds ca. 2 mm long, 1.5–1.8 mm wide; cauline leaves rather dense, yellowish-glaucous or grayish-green 55.
55. Schizocarp with subglobose processes on cocci
- 35. *E. platyphylla* L.
- + Schizocarp nearly smooth, persistent, at first more or less ciliate, later brown and glabrous 36. *E. microsphaera* Boiss.
56. Nectaries mostly 5; seeds greenish-white, smooth; styles nearly free; cauline leaves usually not more than 2 times longer than internodes, generally incised-dentate, scarious, with distinct longitudinal veins; terminal peduncles 3(2) or cyathia solitary; branching plants, rarely with simple stems 57.
- + Nectaries 4; seeds whitish-gray; styles generally more or less connate; cauline leaves usually more than 2 times longer than internodes, entire or hardly crenate, more or less fleshy, with veins inconspicuous or only distinct at base 66.
57. Cyathium 2–3 mm in diameter; seeds compressed-oblong, greenish, with oblique appendage; cauline leaves elliptic, the lower opposite, the upper alternate; annuals, with thin root
- 57. *E. turkestanica* Rgl.
- + Cyathium 3–4 mm in diameter; cauline leaves all alternate; perennials, with thick root 58.
58. Schizocarp ca. 7 mm long, at first with rows of filiform processes, later nearly smooth, with scattered groups of tubercles; cauline leaves and leaves of involucl short-petiolate, orbicular-triangular, undulate at margin 56. *E. schugnanica* B. Fedtsch.
- + Schizocarp shorter than 6 mm, smooth; leaves flat 59.
59. Leaves more or less acuminate, cordate at base, sessile, amplexicaul; stems few, more or less erect, taller than 20 cm, simple;

- peduncles many times 2-branched; seeds with rather large straight appendage 55. *E. bungei* Boiss.
- + Leaves not acuminate, not cordate at base, short-petiolate; stems numerous, more or less spreading, sometimes shorter than 20 cm, branching; peduncles simple or only 1 time 2-branched or cyathia solitary; seeds with small oblique appendage 60.
60. Cauline leaves and leaves of involucre and involucels more or less purple, $2\frac{1}{2}$ to $3\frac{1}{2}$ times longer than wide, the latter nearly 2 times larger than cauline leaves; plants (5)15–30 cm high, strongly branching, especially above 53. *E. tibetica* Boiss.
- 321 + Cauline leaves and leaves of involucre and involucels more or less equal, glaucous, often yellowish, $1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide; plants 5–15 cm high, moderately branching, mainly at base 54. *E. tranzschelii* Prokh.
61. Schizocarp more or less conical; styles not more than $\frac{1}{4}$ as long as fruit, nearly free; nectaries 5 or only 3 or 2; seeds smooth; cauline leaves slightly longer than the short internodes, more or less incised-dentate or entire, fleshy, obscurely palmate-veined; stems distinctly sulcate-ribbed; glabrous plants 62.
- + Schizocarp not conical or if conical then styles more than $\frac{1}{4}$ as long as fruit and connate up to their middle; nectaries usually 4. 64.
62. Cyathium up to 1.5 mm in diameter, with lobes shorter than 0.5 mm; nectaries 5, short-bicornute; styles ca. 1 mm long; seeds with large appendage; terminal peduncles 2–3, short; stems without leafy branches; annuals, rarely higher than 10 cm 60. *E. grossheimii* Prokh.
- + Cyathium wider than 3 mm, with lobes not shorter than 1 mm; styles 1.5–2 mm long; terminal peduncles 3–5, 2.5–10 cm long; stems often with leafy branches; perennials, higher than 30 cm 63.
63. Seeds with appendage as long as seed, oblong and grooved; nectaries 3 or even 2, pectinate or short-bicornute; lobes of cyathium 2–2.5 mm long, entire; leaves of involucels $1\frac{1}{2}$ to 2 times longer than wide; cauline leaves more than 4 times longer than wide 59. *E. ispahanica* Boiss.
- + Seeds with appendage distinctly smaller than seed; nectaries 5, with spatulate horns as long as nectaries; lobes of cyathium 1–1.5 mm long, usually notched-bilobate; leaves of lower involucels hardly longer than wide; cauline leaves not more than 4 times longer than wide 58. *E. alaica* Prokh.
64. Cyathium usually more than 1.5 mm in diameter; peduncles rarely 3 times 2-branched; seeds with appendage, orbicular, smooth or only finely pitted, if seeds hexahedral then stem more or less creeping at base; perennials, with thick root 65.
- + Cyathium not more than 1.5 mm in diameter; peduncles often more than 3 times 2-branched; seeds with or without appendage, whitish, usually angular, wrinkled or strongly sulcate or tuberculate or deeply reticular-pitted; annuals, with thin root (section *Cymatospermum* Prokh.) 130.

- 322 65. Nectaries notched or crestlike outside, crescent-shaped, with more or less colored, not filiform horns or if obtuse-truncate, then hornless; seeds orbicular at cross section; smooth or finely pitted; stems not creeping at base 66.
- + Nectaries obtuse-truncate, with white subfiliform horns; seeds more or less hexahedral, with longitudinal furrow at each face, and also sometimes with few tubercles; stems more or less creeping and often flexuose at base (section *Herpetorrhiza* Prokh.) 128.
66. All leaves more or less fleshy, with palmate venation discernible only at base, sometimes with 3 somewhat parallel ribs, generally approximate on stem; seeds whitish-gray, sparsely finely pitted or rugose or smooth (section *Murtekias* Rafin. em. Prokh.) 67.
- + All leaves not fleshy, with more or less distinct pinnate venation, usually not approximate on stem; nectaries more or less bicornute; styles mostly connate only at base; schizocarp more or less flattened, usually slightly wider than long, deeply trisulcate, with more or less globular cocci; seeds smooth, brownish or dark (section *Esula* Prokh.) 86.
67. Schizocarp deeply trisulcate, distinctly wider than long; seeds subglobulose, whitish, more or less smooth, with small appendage; styles nearly free; lower cauline leaves obtuse, without mucro (subsection *Paraliodeae* Prokh.) 61. *E. paralias* L.
- + Schizocarp slightly trisulcate, not shorter than wide; styles connate for $\frac{1}{3}$ to $\frac{2}{3}$; cauline leaves mucronulate, even if obtuse 68.
68. Schizocarp more or less orbicular in cross section; seeds slightly compressed, with small appendage; lobes of cyathium up to 1 mm long and wide; nectaries hornless, truncate or short-bicornute; staminate flowers bracteate, pistillate with calyx (subsection *Conicocaprae* Prokh.) 69.
- + Schizocarp more or less trihedral; seeds more or less tetrahedral, with rather large appendage; lobes of cyathium more than 1 mm long and wide, often reddish; nectaries bicornute, with long white spatulate forms, if hornless then crustlike; staminate flowers ebracteate, pistillate without calyx (subsection *Myrsiniteae* Boiss.) 78.
69. Styles not longer than 2 mm; cauline leaves usually with subparallel margins, upper leaves generally wider below middle, always veinless at base; leaves of involucre not dilated above middle; stems virgate, usually strongly branching below (series *Seguieriana*) 70.
- 323 + Styles longer than 2 mm; cauline leaves usually wider above middle, with 3 nerves running together in the lower third of leaf; leaves of involucre usually dilated above middle; stems simple; plants often slightly farinaceous-velutinous (series *Nicaeenses*) 74.
70. Leaves of flowering stems obtuse, usually not longer than 15 mm and not wider than 4 mm; upper cauline leaves and leaves of involucre often cordate at base; leaves of involucre often reniform; nectaries bicornute; seeds densely pitted-dotted; plants finely farinaceous-velutinous, grayish 62. *E. petrophila* C. A. M.
- + Leaves of flowering stems usually longer than 15 mm or if shorter, then wider than 4 mm; glabrous and glaucous plants 71.
71. Nectaries truncate, hornless; schizocarp not longer than 4 mm; seeds nearly smooth or obscurely pitted 72.
- + Nectaries bicornute; schizocarp longer than 4 mm; seeds distinctly pitted, nearly wrinkled 73.

72. Leaves of flowering shoots longer than 13 mm, 3 times longer than wide; terminal peduncles not less than 5; seeds nearly smooth; plants usually higher than 15 cm 63. *E. segueriana* Neck.
 + Leaves of flowering shoots not longer than 12 mm, less than 3 times as long as wide; terminal peduncles less than 5; seeds sparingly-finely pitted; plants not higher than 15 cm 64. *E. humilis* Ldb.
73. Cauline leaves acuminate, attenuate at base, faintly glaucous, 3-nerved; leaves of involucels more or less rhombic, not overlapping each other, not wider than 12 mm; cyathium not wider than 3 mm; nectaries with short spatulate horns; stems branching only at base 65. *E. kopetdaghi* Prokh.
 + Cauline leaves rounded at base, obtuse, glaucous, 3-5-nerved; leaves of involucels orbicular-reniform, overlapping each other at base, up to 24 mm wide; cyathium wider than 3 mm; nectaries with subulate horns as long as width of nectary; stems often more or less branching along the entire length 66. *E. sogdiana* M. Pop.
74. Nectaries bicornute, sometimes with dentate-lobate horns; cauline leaves acuminate-acute; terminal peduncles 5-8; plants farinaceous-hairy, 30-45 cm high 67. *E. macroclada* Boiss.
 + Nectaries hornless; cauline leaves abruptly more or less cuspidate 75.
75. Terminal peduncles 7-13; seeds smooth, grayish-green, with brown spots; cauline leaves obtuse, 4 times longer than wide; plants completely glabrous, usually much taller than 20 cm 68. *E. stepposa* Zoz.
- 324 + Terminal peduncles rarely more than 7; seeds whitish, slightly and sparingly pitted-dotted; plants partly somewhat ciliate-velutinous, often higher than 20 cm but never higher than 35 cm 76.
76. Cauline leaves rounded at apex, only sometimes mucronulate, not more than 3 times longer than wide; terminal peduncles 5-8; leaves of involucre orbicular or orbicular-elliptic; leaves of involucels suborbicular-reniform, obtuse, with midrib exserted to form a beak 0.5-1 mm long, distinctly yellowing 71. *E. goldei* Prokh.
 + Cauline leaves generally slightly tapering at apex, usually 3 times longer than wide; terminal peduncles 3-7; leaves of involucre oblong or ovate; leaves of involucels orbicular-triangular, only slightly mucronate, faintly yellowish 77.
77. Cauline leaves less than 5 times longer than wide; leaves of involucre less than $2\frac{1}{2}$ times longer than wide 69. *E. glareosa* M. B.
 + Cauline leaves 5 times longer than wide; leaves of involucre often more than $2\frac{1}{2}$ times longer than wide 70. *E. volgensis* Krysht.
78. Nectaries hornless, crusted-multidentate along the truncate margin (series Denticulatae). Schizocarp ca. 9 mm long, 7 mm wide; seeds rugose; styles ca. 2 mm long, half-connate; cauline leaves and leaves of involucre only slightly longer than wide 80. *E. denticulata* Lam.
 + Nectaries bicornute, with more or less long white spatulate horns; schizocarp up to 7 mm long 79.

79. Cauline leaves usually more than 3 times longer than wide, long-acuminate, entire; seeds smooth, with obtuse appendage; schizocarp flattened above (series *Biglandulosae*) 80.
- + Cauline leaves usually less than 3 times longer than wide, usually abruptly mucronate, more or less crenate (if acuminate and nearly entire, then seeds markedly rugose); seeds more or less (sometimes slightly) rugose (if nearly smooth, then appendage acutely conical) (series *Myrsiniteae*) 81.
80. Cauline leaves 4 to 5 times longer than wide; terminal peduncles 7–12, axillary peduncles absent; leaves of involuclers approximately $1\frac{1}{2}$ times wider than long; cyathium 4.5–5.5 mm in diameter; styles 3–3.5 mm long, half-connate; seeds with horizontal discoid stalked appendage 72. *E. biglandulosa* Desf.
- + Cauline leaves 3 to 4 times longer than wide; terminal peduncles 10–19, axillary peduncles 2–8; leaves of lower involuclers approximately as wide as long; cyathium 2–3 mm in diameter; styles 1.5–2 mm long, connate for three-fourths; seeds with truncate-concave conical appendage 73. *E. monostyla* Prokh.
81. Seeds deeply sulcate-rugose, with truncate-concave conical appendage; styles 1.5–2.5 mm long; peduncles not more than 12 82.
- + Seeds faintly wrinkled or nearly smooth, with acute conical appendage usually looplike [?] above; styles 2–3 mm long 84.
82. Cauline leaves widest at apex ($2\frac{1}{2}$ to $3\frac{1}{2}$ times longer than wide), at apex with teeth longer than 0.5 mm, laterally entire; peduncles simple or once 2-branched, axillary peduncles up to 4; styles 2–2.5 mm long 74. *E. spinidens* Prokh.
- + Cauline leaves widest above the middle (less than 3 times longer than wide), with inconspicuous up to 0.2 mm long teeth at upper half or even subentire; peduncles once or twice 2-branched, axillary peduncles absent or rarely solitary; styles 1.5–2 mm long 83.
83. Cauline leaves with short hamate mucro, usually finely dentate (less than twice as long as wide); leaves of involuclers cordate at base, $1\frac{1}{2}$ times wider than long; glaucous plants 75. *E. tyrsinites* L.
- + Cauline leaves acuminate, subentire (more than twice as long as wide); leaves of involuclers not cordate at base, the lower hardly wider than long, the upper suborbicular, often reddish; grayish plants 76. *E. pontica* Prokh.
84. Leaves of involucre $1\frac{1}{2}$ times or more longer than wide; cauline leaves crenate, 2–3 times longer than wide; terminal peduncles 8–20, axillary peduncles up to 9 (when axillary peduncles obsolete, terminal not less than 12); leaves of lower involuclers very long or very wide, $1\frac{1}{2}$ times longer than wide or wider than long, leaves of upper involuclers suborbicular 77. *E. woronowii* Grossh. em. Prokh.
- + Leaves of involucre less than $1\frac{1}{2}$ times longer than wide; cauline leaves $1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide; terminal peduncles 5–12, axillary peduncles obsolete or 3 at most; leaves of involuclers wider than long or rarely as long as wide 85.

85. Terminal peduncles 7–12 (up to dichasium), up to 2 cm, rarely 2.5 cm long; leaves of involucels usually orbicular, often crenate above, hardly cordate at base, the lower usually not longer than 8 mm or wider than 11 mm; styles 2.5–3 mm long 78. *E. marschalliana* Boiss.
- 326 + Terminal peduncles 4–7 (up to dichasium), usually longer than 2 cm; leaves of involucels approximately $1\frac{1}{2}$ times wider than long; entire, deeply cordate at base, the lower usually longer than 8 mm and wider than 11 mm; styles 2–2.5 mm long 79. *E. armena* Prokh.
86. Leaves of involucels free 87.
- + Leaves of involucels united in pairs for half their length or more; nectaries falcate, with converging horns not less than $1\frac{1}{2}$ times longer than width of nectary (subsection *Patellares* Prokh.) . . . 125.
87. Cauline leaves partly dilated or sometimes narrowly linear, many at least on sterile branches); nectaries falcately curved, if abruptly tapering to 2 rather long subulate horns then nectaries yellowish; rhizome abortive; plants with suckers (subsection *Esulae* Prokh.) 88.
- + Cauline leaves not more than 10, oblong, with more or less parallel margins; stems simple; nectaries dark purple, more or less falcate, abruptly tapering to two subulate, often parallel horns more than $1\frac{1}{2}$ times longer than width of nectary; rhizome developed, moniliform (subsection *Sieboldianae* Prokh.) 124.
88. Styles not thin, connate for approximately half their length, shortly 2-lobed at end; schizocarp dark in color; leaves on stems up to $2\frac{1}{2}$ times longer than wide, leaves on lateral shoots up to 4 times; leaves of branches truncate or obtuse; plants often up to 25 cm high (if higher, then branching semishrubs). (*Series Andrachnoides* Prokh.) 89.
- + Styles thin, connate for less than half or free, more or less bifid; schizocarp usually not colored (if so, then leaves narrowly linear); leaves on stems usually more than $2\frac{1}{2}$ times longer than wide, leaves on lateral shoots more than 4 times; leaves of branches acute or obtuse, rarely truncate; plants usually higher than 25 cm (if lower, then leaves narrowly linear) 93.
89. Cauline leaves and leaves of involucre more than $1\frac{1}{2}$ times longer than wide 90.
- + Cauline leaves and leaves of involucre nearly as wide as long . . . 92.
90. Cauline leaves cordate-amplexicaul at base; leaves of branches not truncate; leaves of involucels less than 7 mm long and 9 mm wide 84. *E. andrachnoides* Schrenk.
- + Cauline leaves not cordate at base; leaves of branches usually truncate; leaves of involucels often larger 91.
- 327 91. Leaves more or less undulate along margin; cauline leaves and leaves of involucre usually truncate or notched at apex; styles shorter than 1.5 mm; herbaceous plants, glabrous, multicaulescent, less than 15 cm high 82. *E. undulata* M. B.
- + Leaves even at margin; leaves of main stem and of involucre usually only obtuse; styles longer than 2 mm; branching semishrubs, often short-hairy, higher than 25 cm 85. *E. buhsei* Boiss.

92. Glabrous plants, with sterile branches only in upper part 81. *E. buschiana* Grossh.
+ Short-hairy plants, branching from base 83. *E. irgisensis* Litv.
93. Cauline leaves and leaves of involucre more or less cuneate at base, widest above middle (at least those on sterile branches); leaves scarious, not glossy; styles connate only at base; fruit with more or less smooth cocci (series *Esulae* Prokh.) 94.
+ Cauline leaves and leaves of involucre more or less dilated and not tapering at base (often auriculate), thick, glossy or hairy (at least the lower cauline leaves); styles usually connate for $\frac{1}{3}$ to $\frac{1}{2}$ 104.
94. Leaves of main stem usually not wider than 1 cm, widest above middle; styles rarely longer than 1.5 mm; plants not yellowish 95.
+ Leaves of main stem, at least a few, wider than 1 cm, widest at the middle or below; leaves of involucels sometimes slightly yellowish 102.
95. Leaves of involucels cuneate at base, flabelliform-spreading above; styles longer than 1.5 mm; nectaries falcate, with converging horns; cauline leaves not wider than 1.5 mm; plants up to 13 cm high 91. *E. karoi* Freyn.
+ Leaves of involucels widest at the middle or below; styles only rarely longer than 1.5 mm; cauline leaves wider than 1.5 mm; plants higher than 15 cm 96.
96. Cauline leaves and leaves of involucre acute or obtuse, the lower cauline leaves sometimes truncate but then stems short-branching; styles 1–1.5 mm long 97.
+ Cauline leaves and leaves of involucre truncate or emarginate (at least a few) 101.
97. Cauline leaves usually more than 6 times longer than wide, rarely less, sometimes sublinear; leaves of involucre often elongate; leaves of involucels ovate-rhombic, cuneate at base 98.
+ Cauline leaves usually not more than 6 times longer than wide, rarely more, usually narrowly oblanceolate, generally obtuse; leaves of involucre oblong or ovate; leaves of involucels rhombic or orbicular-reniform, usually truncate at base 99.
98. Stems with sterile branches; cauline leaves 2–8 mm wide; axillary peduncles 1–23 86. *E. esula* L.
+ Stems without sterile branches; cauline leaves 0.1–7 mm wide; axillary peduncles relatively few 87. *E. microcarpa* Prokh.
99. Stems without sterile branches; cauline leaves often more than 5 times longer than wide; terminal peduncles 4–5, rarely up to 8; plants 16–65 cm high 88. *E. subtilis* Prokh.
+ Stems with sterile branches; cauline leaves rarely more than 5 times longer than wide; plants not higher than 40 cm 100.
100. Terminal peduncles 8–10, axillary 4–15; stems often ascending from base with sterile branches below; cauline leaves obtuse or acute; leaves of involucels rhombic or orbicular-reniform, not overlapping at base; bluish-glaucous plants, more or less pubescent 89. *E. gmelini* Steud.

- + Terminal peduncles 3–8, axillary 1–5; stems erect, with few sterile branches only in the upper part; cauline leaves obtuse or slightly truncate; leaves of involucels suborbicular-reniform, often overlapping at base; plants pale green, glabrous 90. *E. discolor* Ldb.
101. Stems with long sterile branches above; terminal peduncles 7–10; cauline leaves $4\frac{1}{2}$ times longer than wide; leaves of involucels usually $1\frac{1}{2}$ times wider than long; styles ca. 2 mm long 92. *E. borszczowii* Prokh.
- + Stems without sterile branches; terminal peduncles 3–5; cauline leaves not more than $4\frac{1}{2}$ times longer than wide; leaves of involucels nearly two times wider than long; styles up to 1 mm long 93. *E. sareptana* A. Beck.
102. Nectaries hardly bicornute, styles shorter than 1.5 mm; cauline leaves not more than 3 times longer than wide 94. *E. latifolia* Ldb.
- + Nectaries bicornute, horns as long as width of nectary; styles longer than 1.5 mm 103.
103. Cauline leaves more or less unicolor above, 3 times longer than wide; leaves of involucels slightly (usually $1\frac{1}{2}$ times) wider than long; tall plants (34–100 cm) 95. *E. borodini* Sambuk.
- + Cauline leaves often with bright spots at base, less than two times longer than wide; leaves of involucels often nearly two times wider than long; plants not high (12–45 cm) 96. *E. poecilophylla* Prokh.
- 329 104. Cauline leaves usually less than 4 times longer than wide, rarely 5 times, more than 5 mm wide, dilated, rounded or more or less cordate at base, glossy or pubescent; leaves of involucre usually less than 4 times longer than wide (series *Lucidae* Prokh.) 105.
- + Cauline leaves usually 4 times longer than wide and often more than 5 times; cauline leaves and leaves of involucre generally less than 8 mm wide and often much narrower, not dilated at base, if dilated, then auriculate; leaves of involucre often more than 4 times longer than wide (series *Virgatae* Prokh.) 112.
105. Short-hairy plants, up to 70 cm high; cauline leaves lanceolate, 3 times longer than wide, obtuse, orbicular at base; terminal peduncles 8–12 106.
- + Glabrous plants 107.
106. Styles longer than 1.5 mm; nectaries short-bicornute; axillary peduncles 1–16; leaves of involucels bright yellow at anthesis 97. *E. salicifolia* Host.
- + Styles not longer than 1.5 mm; nectaries with horns longer than width of nectary; axillary peduncles few; leaves of involucels yellowish or slightly purple 97. *E. glomerulans* Prokh.
107. Cauline leaves deeply cordate, amplexicaul at base, more or less triangular; styles 1.5–2 mm long 108.
- + Cauline leaves not cordate at base; styles longer than 2 mm 109.
108. Cauline leaves obtuse; nectaries short-bicornute; schizocarp finely tuberculate; styles connate for nearly half, with thick 2 lobes 99. *E. agraria* M. B.

- + Cauline leaves long-cuspidate; nectaries with horns longer than width of nectary; schizocarp rather smooth; styles nearly free, deeply bifid 100. *E. sewerzowii* Prokh.
109. Nectaries short-bicornute; leaves of sterile branches cuneate at base, dilated above middle; schizocarp smooth 101. *E. mandshurica* Maxim.
- + Nectaries with more or less conspicuous horns; schizocarp dotted-tuberculate 110.
110. Cauline leaves 5–12 cm long, usually more than 4 times longer than wide 102. *E. lucida* W.K.
- + Cauline leaves shorter than 7 cm, usually less than 4 times longer than wide 111.
111. Cauline leaves usually less than $2\frac{1}{2}$ times longer than wide, not acuminate, sometimes incised-truncate (on sterile branches); peduncles infrequently more than 10; leaves of involucels more or less yellow; nectaries with horns not longer than width of nectary 103. *E. iberica* Boiss.
- + Cauline leaves 2 to 4 times longer than wide, more or less acuminate; peduncles less than 10; leaves of involucels not yellow; nectaries with horns longer than width of nectary 104. *E. pseudagraria* P. Smirn.
112. Stems usually branching from base with numerous densely leafy sterile branches; leaves not wider than 1.5 mm, acuminate, often falcately curved, scarious 113.
- + Stems with few sterile branches at the middle or above; leaves of sterile branches straight, sometimes obtuse, mucronate 118.
113. Plants generally higher than 30 cm, glabrous; cauline leaves usually longer than 2.5 cm; nectaries with horns longer than width of nectary; styles 1–1.5 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$; schizocarp with nearly smooth cocci 114.
- + Plants lower than 30 cm; cauline leaves shorter than 2.5 cm, if longer then plant pubescent; nectaries short-bicornute; schizocarp usually with dotted and finely tuberculate cocci 115.
114. Leaves of involucels as long as wide or slightly longer; lateral leafy shoots often ending with additional cymose umbels at the same level of the main ones 105. *E. uralensis* Link.
- + Leaves of involucels almost $1\frac{1}{2}$ times wider than long; lateral leafy shoots sterile 106. *E. pamirica* Prokh.
115. Styles shorter than 1 mm, connate only at base; cauline leaves more than 6 times longer than wide, sometimes obtuse; plants often pubescent, more or less purple above 116.
- + Styles longer than 1 mm, connate for $\frac{1}{3}$ to $\frac{1}{2}$; cauline leaves less than 6 times longer than wide, usually mucronate; glabrous plants, not purple 117.
116. Terminal peduncles more than 10; leaves on branches not wider than 0.6 mm [cm?], sometimes hirsute; leaves of involucels always slightly wider than long, pale; glabrous plants 107. *E. cyparissias* L.
- + Terminal peduncles 4 or less; leaves on branches wider than 0.5 mm [cm?]; leaves of involucels elongate in both directions; short-hairy plants 108. *E. astrachanica* C. A. M.
117. Styles 1–1.5 mm long; plants not higher than 15 cm, with few stems 109. *E. tschuiensis* (Prokh.) Serg.

- + Styles longer than 1.5 mm; plants higher than 15 cm, multi-caulescent 110. *E. cyrtophylla* Prokh.
 331 118. Terminal peduncles 1-5; leaves of involucre similar to cauline leaves; low plants (up to 20 cm) 111. *E. guntensis* Prokh.
 + Terminal peduncles not less than 5; higher plants 119.
 119. Styles shorter than 1.5 mm, nearly free; cauline leaves usually more than 30 times longer than wide; cauline leaves and leaves of involucre long-acuminate; stems usually not branching, not thicker than 1.5 mm; leaves of involucels more or less rhombic, often angular; terminal peduncles 5 or less 112. *E. leptocaula* Boiss.
 + Styles longer than 1.5 mm, connate for $\frac{1}{3}$ to $\frac{1}{2}$; cauline leaves less than 20 times longer than wide; leaves of involucels not angular; terminal peduncles 5 and more 120.
 120. Culine leaves dilated below middle; axillary peduncles usually up to 10; sterile leafy branches and axillary peduncles developed at upper part of stem; glabrous plants 121.
 + Culine leaves usually with parallel margins; axillary peduncles sometimes rather numerous, at upper third of stem; leafy sterile branches developed at middle part of stem or completely absent ..
 122.
 121. Culine leaves usually acuminate 113. *E. virgata* W.K.
 + Culine leaves usually rounded at apex, sometimes mucronulate ..
 114. *E. boissieriana* (Woron.) Prokh.
 122. Culine leaves longer than 4 cm; leaves thick; stems more or less pubescent at base; glaucous, tall (up to 100 cm) plants
 115. *E. jaxartica* Prokh.
 + Culine leaves not longer than 4 cm; leaves scarious; stems usually glabrous; grayish plants, not tall (up to 50 cm) 123.
 123. Culine leaves not dilated at base, 9 times or more longer than wide; leaves of involucre usually more than 4 times longer than wide 116. *E. zhiguliensis* Prokh.
 + Culine leaves more or less dilated-auriculate at base, less than 10 times longer than wide; leaves of involucre usually less than 4 times longer than wide 117. *E. subcordata* Ldb.
 124. Culine leaves usually longer than 2.8 cm, more than $2\frac{1}{2}$ times longer than wide; leaves of involucre more than 2 times longer than wide; leaves of involucels usually longer than wide
 118. *E. sieboldiana* Morr.
 + Culine leaves not longer than 2.8 cm, less than $2\frac{1}{2}$ times longer than wide; leaves of involucre less than 2 times longer than wide; leaves of involucel wider than long 119. *E. savaryi* Kiss.
 332 125. Stems often dimorphic: the lowermost sterile and those above them fertile; leaves of sterile shoots and at the lower part of fertile shoots relatively large and dense, the upper leaves smaller, and remote, if approximate-rosetted leaves absent, then plants glabrous and leaves sessile 126.
 + Fertile and sterile stems equal; leaves more or less petiolate, more or less equal; pubescent plants 127.

126. Typical leaves of sterile shoots and the lower on fertile shoots usually less than 3 times longer than wide, other leaves of fertile shoots not longer than 2.5 cm and not wider than 1.3 cm; terminal peduncles 5–6 and axillary 4–9 120. *E. amygdaloides* L.
- + Typical leaves of sterile shoots and the lower on fertile shoots usually more than 3 times longer than wide, or completely absent; leaves of fertile shoots usually longer than 2.5 cm and wider than 1.2 cm; terminal peduncles 5–13 and axillary 8–40 121. *E. glaberrima* C. Koch.
127. Cauline leaves obtuse, 3–7.5 cm long; petioles shorter than 0.5 cm; leaves of involucre rarely longer than 3 cm; terminal peduncles (first internode) not longer than 3.5 cm, axillary peduncles rarely longer than 5 cm; plants not higher than 70 cm 122. *E. oblongifolia* C. Koch.
- + Cauline leaves acute, 6–14 cm long; petioles longer than 1 cm; leaves of involucre longer than 3 cm; terminal peduncles (first internode) longer than 4.5 cm, axillary peduncles longer than 5 cm; plants usually higher than 70 cm 123. *E. macroceras* Fisch. et Mey.
128. Stems flexuous and strongly branching especially at base; cauline leaves and leaves of involucre cuneate at base, dilated at apex, truncate, increasing in dimensions from the lower cauline to leaves of involucre; leaves of involucels dilated at the middle or above, rounded at apex; horns of nectaries $1\frac{1}{2}$ times longer than width of nectary; styles ca. 1 mm long; seeds slightly tuberculate. 126. *E. polytimetica* Prokh.
- + Stems straight, simple; cauline leaves and leaves of involucre more or less equal, not cuneate at base, usually tapering, obtuse at apex; leaves of involucels dilated below middle, often short-mucronate; horns of nectaries approximately as long as width of nectary; seeds compressed at edges, nearly smooth 129.
129. Cauline leaves less than 4 times longer than wide, subentire, grayish-glaucous, sometimes reddish, more or less evenly disposed; leaves of involucels mucronulate, entire; cyathium 1.5–2 mm in diameter; styles up to 1.3 mm long 124. *E. aucheri* Boiss.
- 333 + Cauline leaves more than 4 times longer than wide, finely serrate, pale green, scarious, usually at the lower part of stem; leaves of involucels more or less acuminate, crenate; cyathium 2.5–3 mm in diameter; styles longer than 1.3 mm 125. *E. deltoabracteata* Prokh.
130. Leaves of involucels sometimes partly united in pairs, obtuse, entire; horns of nectaries as long as width of nectary; styles 0.8–1 mm long; schizocarp more or less trihedral, ca. 4 mm long; seeds tetrahedral, without appendage; hairy plants up to 10 cm long (subsection *Densiusculae* Prokh.) 146. *E. densiuscula* M. Pop.
- + Leaves of involucels free; schizocarp not longer than 3 mm; glabrous plants, rarely only farinaceous-scarious 131.
131. Stems many, simple; cauline leaves very dense and several disposed in 1 mm of stem length, the lower hirsute, less than 0.5 mm wide; leaves of involucels more than 10 times wider than lower

- cauline leaves, mucronate, irregularly acutely toothed; nectaries with conspicuous horns; styles longer than 0.8 mm; seeds more or less orbicular, densely white-tuberculate, without appendage 127. *E. aleppica* L.
- + Stems solitary or if numerous, then usually more or less branching; cauline leaves more than 0.5 mm wide, with short (more than $\frac{1}{10}$ the length of leaf) but distinct internodes between; leaves of involucels not more than 5 times wider than cauline leaves, entire or regularly toothed; seeds usually angular (or deeply pitted), with or without appendage 132.
132. Leaves of involucre and lower involucels and sometimes upper cauline leaves dilated at base, often auriculate; cauline leaves linear, generally truncate, the lower approximate, internodes usually less than $\frac{1}{5}$ the length of leaf; stems usually few, rather long, often with sterile branches 133.
- + Leaves of involucre and lower involucels not dilated at base or only slightly so; cauline leaves somewhat remote, internodes rarely less than $\frac{1}{5}$ the length of leaf 134.
133. Cauline leaves not wider than 1.5 mm, yellow-green, delicate; terminal peduncles (up to dichasium) usually not longer than 1.5 cm; leaves of involucels not longer than 1 cm nor wider than 2.5 mm; horns of nectaries slightly shorter than width of nectary; styles shorter than 0.6 mm; seeds tetrahedral, finely tuberculate, with small appendage 128. *E. exigua* L.
- + Cauline leaves wider than 2 mm, glaucescent, rather thick; terminal peduncles (up to dichasium) longer than 1.5 cm; leaves of involucels longer than 1 cm and wider than 5 mm; horns of nectaries twice as long as width of nectary; styles 1 mm long or even longer; seeds ovate, reticulate-pitted, with conical appendage 129. *E. graeca* Boiss. et Sprun.
334. Nectaries with horns not less than $1\frac{1}{2}$ times longer than width of nectary; many-stemmed or branching plants, rarely with simple solitary stem 135.
- + Nectaries with horns shorter than width of nectary; plants with many more or less branching stems or with single, simple stem 137.
135. Cauline leaves and leaves of involucre and involucels subsessile, linear, not wider than 2.5 mm, sometimes slightly dilated at base, rather thick; seeds ovate, uninterruptedly reticulate-pitted, with small appendage; styles 0.5–0.7 mm long; plants usually with single stem slightly branching or simple 130. *E. ledebourii* Boiss.
- + Cauline leaves and leaves of involucre petiolate, cuneate at base, wider than 4 mm, obtuse, scarious; seeds hexahedral, with a broad longitudinal furrow at edge; plants usually multicaulescent, with sterile branches 136.
136. Coccis with 2 longitudinal keels; styles only 0.1–0.2 mm long; seeds with a furrow only at the inside edge, and 3 to 4 deep and rounded pits along the other edges 131. *E. peplus* L.

- + Cocci without keel; styles 0.5–0.7 mm long; seeds with 1 longitudinal furrow on each edge 132. *E. aulacosperma* Boiss.
137. Leaves of involucre and upper cauline leaves cuneate at base, widest (usually 3 mm and more) above middle, 3-nerved; styles usually longer than 0.8 mm, infrequently 0.6 mm long; plants usually with many elongate stems developing sterile branches, rarely with single simple stem 138.
- + Leaves of involucre and upper cauline leaves with more or less parallel margins or slightly dilated below middle, 1-nerved; styles not longer than 0.7 mm; plant nearly always 1-stemmed, with stem simple, short, broadly branching at inflorescence (subsection *Oppositifoliae* Boiss.) 141.
138. Leaves of involucels (except for the lower) not wider than 4 mm, obtuse, more than 4 times longer than wide; styles 0.6–0.8 mm long; seeds hexahedral, finely tuberculate at rib and with inconspicuous appendage; plant commonly 1-stemmed, without leafy branches 136. *E. francheti* B. Fedtsch.
- 335 + Leaves of involucels wider than 5 mm, sometimes falcately curved, usually mucronate, only 2 times longer than wide; styles longer than 0.8 mm; seeds tetrahedral; plants multicaulescent, if 1-stemmed, then stem with leafy branches, rarely simple . . . 139.
139. Seeds without appendage, with longitudinally pitted pits, sometimes confluent, biseriate at outer edge; schizocarp slightly longer than wide; styles 0.8–1 mm long; leaves of involucels falcate, mucronate 135. *E. normanni* Lipsky.
- + Seeds with transverse disconnected furrows on surface, with easily falling appendage; schizocarp more than 1½ times longer than wide; styles 1 mm long and longer 140.
140. Leaves of involucels with mucro ca. 1 mm long, often falcately curved, rarely purple; leaves thick; seeds longer than 1 mm, with 5–10 transverse furrows on surface 133. *E. falcata* L.
- + Leaves of involucels shortly mucronulate, not curved, usually purple; leaves not thick; seeds not more than 1 mm long, with 3–4 transverse furrows on surface . . . 134. *E. acuminata* Lam.
141. Leaves of involucels not wider than 5 mm, entire, more than 2 times longer than wide; cauline leaves hardly petiolate, long-cuneate at base 142.
- + Leaves of involucels wider than 4 mm, finely dentate or entire, less than twice as long as wide; cauline leaves petiolate, abruptly extending from petiole 147.
142. Schizocarp nearly trihedral, with acutely ribbed cocci, hardly trisulcate; styles 0.2–0.3 mm long; seeds tetrahedral, rugose-tuberculate, with subsessile appendage; lower cauline leaves spatulate, dilated above; leaves of involucels falcately curved 145. *E. szovitsii* Fisch. et Mey.
- + Schizocarp with 3 orbicular cocci, distinctly trisulcate; styles longer than 0.4 mm; seeds hexahedral; leaves linear or narrowly lanceolate 143.
143. Leaves of involucels longer than 2 cm, usually obtuse; seeds without appendage; plants rather large, up to 22 cm high 141. *E. consanguinea* Schrenk.

- + Leaves of involucels shorter than 2 cm, acute or rarely obtuse, sometimes tridentate; seeds with appendage; smaller plants 144.
- 144. Seeds with conical obtuse sessile appendage; leaves of upper involucels only 2 to 3 times longer than wide 140. *E. aserbajdzhanica* Bordz.
- + Seeds with horizontal disklike stalked appendage; leaves of involucels more than 3 times longer than wide 145.
- 336 145. Leaves of involucels incised-tridentate at apex, laterally entire; styles not longer than 0.3 mm; seeds (excluding appendage) 1.8–2 mm long 138. *E. triodonta* Prokh.
- + Leaves of involucels completely entire, acute or obtuse 146.
- 146. Leaves of involucels with parallel margins, less than 2 mm wide; styles longer than 0.4 mm; seeds (excluding appendage) 1.2–1.5 mm long 137. *E. inderiensis* Kar. et Kir.
- + Leaves of involucels slightly dilated at base, more than 2 mm wide; seeds (excluding appendage) ca. 2.5 mm long 139. *E. sororia* Schrenk.
- 147. Leaves of involucels about twice as long as wide; seeds pyramidal-hexahedral, uniformly wrinkled, without appendage 142. *E. turczaninovii* Kar. et Kir.
- + Leaves of involucels as long as wide or $1\frac{1}{2}$ times longer; seeds tetrahedral, with straight appendage 148.
- 148. Leaves of involucels up to $1\frac{1}{2}$ times longer than wide, obtuse, entire, not all approximate; schizocarp with orbicular cocci, deeply trisulcate; seeds whitish, obscurely rounded-angular, tuberculate or wrinkled 143. *E. arvalis* Boiss. et Heldr.
- + Leaves of involucels approximately as long as wide, abruptly mucronate, finely toothed at apex, generally approximate; schizocarp with slightly keeled cocci, faintly trisulcate; seeds greenish or ash-gray, distinctly tetrahedral, shallowly rugose-sulcate 144. *E. densa* Schrenk.

Section 1. *SCLEROCYATHIUM* Prokh. sect. — *Sclerocyathium* Prokh. *Obz. moloch. Sr. Azii* (1933) 30. — See page 238 of Key for characteristics of the section.

Monotypic section with only one species — *E. sclerocyathium* — indigenous to the Transcaspiian deserts.

Note. This species is morphologically distinctive due to solitary cyathia with 5 nectaries and nearly squamiform leaves sparse on virgate shoots. Although these characters are sufficient for sectional delimitation, they still are insufficient to establish an independent genus of this taxon.

1. *E. sclerocyathium* E. Kor. et M. Pop. in Sched. ad Herb. Fl. As. Med. XI–XIII (1927) 41, No. 304. — *Sclerocyathium* Popovii Prokh., *Obz. moloch. Sr. Azii* (1933) 30. — *Tithymalus sclerocyathium* (E. Kor. et M. Pop.) Prokh. comb. nova, nomen altern. — Ic.: Prokh. l. c. tab. 7. — Exs.: H. F. A. M. No. 304.

337 Perennial (or shrubs), 30–40 cm high, glabrous; root woody; stems numerous, cespitose, erect, virgate, slightly indurate at base, much branching, with sparsely leafy branches, the lower sterile, the upper with solitary cyathia at summit; cauline leaves alternate, rather small (nearly squamiform), several times shorter than internodes, sessile, lanceolate-elliptic or rarely linear-lanceolate, 8–15 mm long, 2–6 mm wide, entire, acuminate, usually recurved at margin, thick, inconspicuously nerved, smaller on branches. Cyathia solitary, rarely on 3–4 approximate apical branches resembling a cymose umbel; leaves of involucels 2, comparatively very small, oblong-lanceolate, usually rounded at base; cyathium campanulate, 5–6 mm in diameter, hardening, glabrous outside, hairy inside, with acute triangular ciliate lobes; nectaries 5, transversely oblong, rounded at outer margin, slightly impressed above; styles 0.5–1 mm long, connate at base, rounded, shortly 2-lobed; schizocarp globulose-ovoid, 4–5 mm long, trisulcate, smooth; seeds ovate, 2–3 mm long, orbicular at cross section, pale gray, finely pitted, with ovate-conical appendage (3 times shorter than seeds). Fl. May, Fr. July.

Stony deserts and sands. — Centr. Asia: Ar.-Casp. (Mangyshlak Peninsula), Kara K. (near Krasnovodsk Gulf). Endemic. Described from railway station Kara-Tengir near Krasnovodsk. Type in Tashkent.

Note. This species is unquestionably of interest not only because of its habit but because of its ecology as a desert plant. Its distribution area is confined to the deserts of the eastern shores of the Caspian.

Section 2. HOLOPHYLLUM Prokh. sect. comb. nova. — Genus *Tithymali* subgen. *Holophyllum* Prokh., Obz. moloch. Sr. Azii (1933) 68. — See page 311 of the Key for characteristics of the section. — Type of section — *E. rupestris* C. A. M. ex Ldb.

The species of this section are concentrated in Asia, except for its tropical and circumpolar parts. The group is absent in the Caucasus, but richly represented in Soviet Central Asia and is also typical for the mountains of China.

Series 1. *Rupestres* Prokh. — See page 238 of the Key for characteristics of the series. Type of the series: *E. rupestris* C. A. M. ex Ldb.

This series is distributed in the mountains of Asia from the Pacific Ocean to Pamir-Alai in the west and from Altai in the north to the Himalayas in the south. Most of these are mountainous species except for *E. mongolica* and *E. pallasi*, which are steppical plants, and *E. komaroviana*, which is a forest species, morphologically distinguished (short styles, naked cyathium, etc.) and probably the oldest in the series.

There are about 15 species in the series, of which 9 are found in the USSR.

338 2. *E. serawschanica* Rgl. Descr. Pl. nov. Fedtsch. (1882) 78. — *Tithynidlus serawschanicus* (Rgl.) Prokh., Obz. moloch. Sr. Azii (1933) 68, nomen altern. — Ic.: Prokh. l. c. tab. 13. — Exs.: H. F. A. M. No. 308 (var. *hirta* Eug. Kor.).

Perennials, 10–40 cm high; root creeping; stems quite many, erect, simple, crisp-hairy above, rarely glabrous; basal leaves sheathed, persistent; cauline leaves alternate, sometimes approximate nearly whorled, short-petiolate, rounded at base, oblong-lanceolate or elliptic, 2–5.5 cm long, 0.7–1.8 cm wide, widest below middle, obtuse or short-mucronate, entire, pubescent, rarely glabrous. Terminal peduncles 5, simple, strongly pubescent, with solitary cyathia at end; leaves of involucre oblong-ovate, 1.5–4.3 cm long, 0.7–1.6 mm wide; leaves of involucels 2, ovate or elliptic, 8–25 mm long, 5–15 mm wide, many times longer than cyathia and usually not overlapping each other; cyathium turbinate, ca. 4.5 mm wide, villous outside or sometimes glabrous, densely tomentose inside, with large ovate villous lobes; nectaries reniform; styles 3–4 mm long, half-connate, bifid; schizocarp inconspicuously stalked with base concealed in cyathium, 7–8 mm long, not deeply trisulcate, nearly smooth, glabrous or pubescent; seeds compressed-ovate, 5–6 mm long, smooth, brown-spotted, with obtuse conical appendage. Fl. May–June, Fr. June–July.

Stony slopes in alpine belt at elevations of 2,000–3,500 m. – Centr. Asia: T. Shan (Chotkal-Tau mountains, Fergana Range), Pam.-Al. (Zeravshan Range, Gissar Range). Endemic. Described from Saratal gorge in the Zeravshan River valley. Type in Leningrad.

3. *E. monocyathium* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 552. – *Tithymalus monocyathium* Prokh. *ibid.* nomen. altern.; Obz. moloch. Sr. Azii, 70. – Ic.: Prokh., Obz. moloch. tabl. 14.

Low perennials, usually glabrous; root not thick, branching, multicipital; stems many, ascending or prostrate, 6–15 cm high, obscurely striate, glabrous, more or less reddish, densely leafy; basal leaves sheathed, persistent; cauline leaves alternate, hardly petiolate, ovate or elliptic, 1–2.3 cm long, 0.5–1.2 cm wide, obtuse or mucronate, entire, glabrous, often reddish. Cyathia solitary at top of stem owing to abortive inflorescence, rarely 2–3; leaves of involucre triangular-ovate or elliptic, 0.7–2 cm long, 0.4–1.5 cm wide, obtuse or sometimes mucronate; cyathium turbinate, 3–4 mm in diameter, glabrous outside, tomentose inside, with lobes large, ovate, obtuse, 339 purple, ciliate at margin; nectaries reniform; styles 1.5–2.5 mm long, half-connate, 2-lobed; schizocarp inconspicuously stalked, ovoid, 6–7 mm long, smooth; seeds? Fl. June, Fr. August.

Exposed stony slopes and river valleys. – Centr. Asia: T. Sh. (Fergana Range), Pam.-Al. (Alai Range, Trans-Alai Range, Pamir). Gen. distr.: Dzu.-Kash. (Uch Turfan). Described from Alai Range, from the Isfairam River valley one kilometer south of Tengizbai pass. Type in Leningrad.

Note. According to their distribution areas *E. monocyathium* and *E. serawschanica* are vicarious species; in the contact zone of Fergana Range there are, however, intermediate forms, which make it difficult to define these otherwise well-defined taxa.

4. *E. rosularis* A. Theod. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, IX (1941) 50. – Ic.: A. Theod. l. c. tab. 1.

Perennial plants, glabrous except for inflorescence; root thickened; stems quite numerous, ascending from the often creeping base, irregularly leafy; cauline leaves (except for uppermost areas) small, squamiform, ovate, brown, dry-scarious. Cymose umbel weakly developed; terminal

peduncles few or solitary, simple, short, longitudinally furrowed, finely pubescent; leaves of involucre and upper cauline leaves approximate like in a rosette, short-petiolate, orbicular-obovate or rhombic or rarely ovate, 2.5–3.5 cm long, 1.8–2.5 cm wide, cuneate at base, obtuse or even rounded at apex, sometimes weakly crenate, a little thick (when fresh), fleshy, glabrous, more or less purple at margin and beneath; leaves of involucels ovate, acuminate; cyathium subglobular-turbinate, short-hairy outside, glabrous inside, lobes orbicular, incurved; nectaries reniform, dark violet; styles half-connate; schizocarp distinctly stalked, triangular-orbicular, glabrous, purple-brown; seeds ovate-oblong, smooth, with small sessile appendage. Fl. August–September, Fr. September.

Stony slopes and taluses, among juniper stands, at elevations of 2,500–2,800 m. — Centr. Asia: Pam.-Al. (Turkestan Range). Endemic. Described from the Guralash-Kulsai game reserve in Zaamin village on the northern slope of Turkestan Range. Type in Leningrad.

5. *E. tianshanica* Prokh. in Izv. Glavn. Bot. Sada. SSSR, XXIX (1930) 553. — *E. rupestris* auct.; B. Fedtsch. in O. and B. Fedch., Perech. r. Turk. (1916) 304, non Ldb. — *Tithymalus tianshanicus* Prokh. l. c. nomen altern.; Obz. moloch. Sr. Azii, 72. — Ic.: Prokh., Obz. moloch. tabl. 15.

340 Perennial plants, 10–30 cm high; root multicapital; stems erect, crisp-hairy in upper part; basal leaves squamiform, persistent; cauline leaves alternate, sometimes nearly whorled, sessile, cordate at base, ovate or rarely elliptic, 1.5–3 cm long, 1–2 cm wide, widest at the lower part, obtuse, subglabrous. Terminal peduncles 4–6, 3–5 cm long, 2-branched at apex or rarely simple; leaves of involucre broadly rhombic-ovate or ovate or ovate-elliptic, 1.7–2.5 cm long, 1–1.6 cm wide; leaves of involucels 2, rhombic-reniform, usually obtuse, shorter than wide to infrequently as long as wide, the lower 1–1.5 cm long, 1.3–1.8 cm wide; cyathium turbinate, 4–5 mm in diameter, hairy inside and out, with large orbicular lanate lobes; nectaries reniform; styles 2–2.5 mm long, half-connate, 2-lobed; schizocarp ovoid, ca. 7 mm long, deeply trisulcate, smooth; seeds compressed-ovate, 5–6 mm long, smooth, brown-spotted, with flattened short-stalked incurved appendage. Fl. ? Fr. July–half August.

Rocks and cliffs in the subalpine belt. — Centr. Asia: T. Sh. (Kalkagar-Tau and Kungei Ala-Tau ranges, San-Tash mountain pass). Gen. distr.: Dzu.-Kash. (Kizyl-Su River basin near Shur-Bulakh). Described from Kungei Ala-Tau, from the village of Kokoirak near the source of the Greater Kemin River. Type in Leningrad.

Note. Although this species is known so far from only four localities, one of them outside the USSR, it is a good one. It might be an eastern race of *E. serawschanica*, i. e., distinguished morphologically by the bifurcate peduncles and the form of the leaves, but separated geographically being confined to central Tien Shan (near Issyk-Kul Lake and more to the south). Its distribution area would be more accurately defined if localities could be found.

6. *E. prokhanovii* M. Pop. in Byull. Mosk. Obshch. isp. prir. XLVII, 1 (1938) 87.

Perennial low plants, glabrous; root cylindrical, elongate, thin, 1–2-cipital; stems 10–15 cm long, erect, thin, creeping and flexuous, often

reddish at base; cauline leaves dense, hardly petiolate, oblong or oblong-lanceolate, 2–3.5 cm long, 0.7–1.4 cm wide, slightly acute or obtuse, somewhat coriaceous, glaucous, cuneate and not cordate at base. Terminal peduncles 3–5, thin, simple; leaves of involucre shorter than peduncles, similar to cauline leaves but more acute, sometimes nearly acuminate; leaves of involucels broadly rhombic-ovate, ca. 1 cm long, 1 cm wide; cyathium subglobular, glabrous outside, lobes ovate, ciliate at margin; nectaries small, transversely elliptic, glabrous, dark; styles 2–2.5 mm
341 long; schizocarp short-stalked, globulose-ovoid, 5–6 mm long, ca. 5 mm wide, weakly trisulcate, glabrous, cocci rounded dorsally; seeds ovate, ca. 4 mm long, smooth, dark brown, faintly spotted, with rather large mushroomlike but sessile appendage. Fl. ? Fr. August.

Rocky calcareous cliffs. — Centr. Asia: T. Sh. (Kungei Ala-Tau Range, sources of the Chilik River, Aktash). Endemic. Described from Kungei Ala-Tau (from the cliffs of Ak-Tash near the source of the Chilik River).

Note. According to M. G. Popov this species resembles *E. tianshanica* Prokh., differing from it by being glabrous, with leaves narrower at base, not cordate, peduncles of the cymose umbel simple, cyathia glabrous, fruits and seeds smaller, and appendage of seed sessile.

In the related *E. serawschanica* Rgl., the common pubescent form and the rarer glabrous one are united in the same species; the leaf base is inconstant in the degree of attenuation or orbicularity. Consequently it seems that there is no basis for making an exception in separating *E. tianshanica* Prokh. and *E. prokhanovii* M. Pop. according to these characters. Moreover, the two latter species are described from the same Kungei Ala-Tau in which they are sympatric. Finally, it would be rather improbable to include two closely related species with overlapping distribution areas in the series *Rupestres* with its obvious vicariousness, a rarity in *Euphorbia*. It appears to me therefore that in the future *E. prokhanovii* M. Pop. will be just a synonym of *E. tianshanica* Prokh. The best criterion is their common character of involucels of two leaves, wider than long.

In view of the fact that I have not yet examined the characters of fruits and seeds indicated by Popov, and am still looking for more investigation by Kazakhstan botanists, I am cautiously retaining *E. prokhanovii* M. Pop., although from my point of view it should not be accepted as such.

7. *E. rupestris* C. A. M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 26; Ldb. Fl. alt. IV (1833) 190; Fl. Ross. II, 563; Boiss. in DC. Prodr. XV, 2, 114; Kryl., Fl. Zap. Sib. VIII, 1867. — *Tithymalus Ledebourianus* Prokh. nomen altern. novum. — *T. rupester* Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 73, non Lam. 1778. — Ic.: Ldb. Ic. pl. Fl. Ross. tab. 190.

Perennial glabrous plants, 7–20 cm high; root vertical or obliquely descending, 20–30 cm long, 1–1.5 cm thick, fleshy, usually branching, with brownish-gray bark; stems erect, usually reddish, the floriferous ones 1–3 in number, the sterile single; leaves on fertile stems partly alternate but partly opposite or whorled, usually crowded in the lower part of stem, short-petiolate (with broad petioles), obovate or oblong-obovate, cuneate at base, 2–5 cm long, 1–2.5 cm wide, obtuse, the lowermost sometimes

342 emarginate, entire; leaves on sterile shoots rather numerous, regularly alternate. Terminal peduncles 3–5, nearly as long as stem, 2- or rarely 3-branched; leaves of involucre obovate or rhombic-ovate, 1.5–3.5 cm long, 1–1.5 cm wide, obtuse, short-cuneate at base; leaves of involucels sessile, ovate-rhombic or broadly triangular, acuminate, usually 2, in the lower sometimes 3; cyathium broadly campanulate; nectaries reniform, black-purple; schizocarp ovoid-truncate, ca. 6 mm long, distinctly trisulcate, smooth; seeds ovate, ca. 4.5 mm long, smooth. Fl. May.

Steppes, valleys of mountain stream, cliffs and stony outcrops on slopes. — West Siberia: Alt. Endemic. Described from the Chagan River valley in Altai. Type in Leningrad.

Note. According to article 48 of the international rules of botanical nomenclature, the author of this species should be Ledebour, and not C. A. Meyer, as has been accepted up to now. Meyer gave the name, but not the description. Ledebour made the description in 1830 without even mentioning the author of the name. Only in 1833, in redescribing the species, he commented on having used Meyer's name for this species.

8. *E. mongolica* Prokh. in Izv. Glav. Bot. Sada SSSR, XXIX (1930) 558. — *E. Pallasii* auct.; Prokh. in Izv. Akad. Nauk SSSR (1927) 202, non Turcz. — *Tithymalus mongolicus* Prokh. in Izv. Glav. Bot. Sada, XXIX (1930) 558, nomen altern. — Ic.: Prokh. l. c. 559, tab. 1.

Perennial glaucous plants, 8–42 cm high, glabrous or rarely pubescent; root creeping, 2–3 cm thick, branching, multicapital; stems quite numerous, appearing tufted with the relics of the previous year, erect, 5–26 cm high, rounded, striped; basal leaves squamiform, somewhat reddish, nearly always deciduous; cauline leaves (except for the upper) alternate, subsessile, short-cuneate at base, rhombic-lanceolate or elliptic, 2.5–4.5 cm long, 1–2 cm wide, obtuse, flat, entire, the uppermost more or less approximate to nearly whorled, often in one additional whorl under inflorescence, ovate-triangular. Terminal peduncles 5, glabrous, suberect, branching into 2–3 secondary, sometimes bifurcate peduncles; leaves of involucre cuneate at base, rhombic-ovate or ovate-triangular, up to 3.6 mm [cm?] long, up to 2.7 cm wide; leaves of involucels orbicular-triangular, the lower usually 3, the upper 2; cyathium broadly campanulate, 2–3 mm long, 5–6 mm in diameter, inside and outside more or less pubescent, lobes orbicular, densely villous at margin (ca. 0.8 mm in diameter); nectaries reniform, undulant at margin; 343 styles 2–2.5 mm long, half-connate, bifid; schizocarp flattened-globulose, 5–6 mm long, 6–7 mm wide, smooth, more or less hairy, deeply trisulcate, with hardly keeled cocci; seeds compressed-ovate, up to 4 mm long, gray-brown, smooth, with obtuse conical brown appendage. Fl. May, Fr. June.

Mountains, cliffs and taluses. — E. Siberia: Ang.-Say. (S. Sayans, left bank of Turak River opposite Turak village; Ulu-Khem River at the mouth of the Elegest). Gen. distr.: Mong. (Mongolian Altai, Khangai Range). Described from Mongolian Altai, from Ikhe Bogdo Range. Type in Leningrad.

9. *E. pallasii* Turcz. [Cat. baic. (1838) No. 1004, nomen] Fl. baic.-dah. II, 2 (1852) 85; Ldb. Fl. Ross. III, 565; Boiss. in DC. Prodr. XV, 2, 114. — *E. verticillata* Fisch. in Mém. Soc. Nat. Mosc. III (1812) 81, non Poir. (1811). — *Tithymalus Pallasii* (Turcz.) Kl. et Gke.

ex Klotzsch. in Abh. Akad. Berl. 1859 (1860) 75, nomen altern. —
Ic.: Boiss. Ic. Euph. (1866) tab. 62. — Exs.: G.R.F. No. 2581
("E. verticillata Fisch.").

Perennial plants, 10–30(40) cm high, glabrous or pubescent; root thick, branching; stems 7–20(30) cm high, 5–6 mm thick, with upper internode 2–5.5(6) cm long, the sterile often higher; basal leaves squamiform, cauline leaves 5 or rarely 4 in a whorl, rounded or rarely slightly tapering at base, oblong or elliptic or oblong-lanceolate, 4–5.8(7.3) cm long, 1.2–2.8 cm wide, obtuse, recurved above at margin, the lower sometimes alternate, leaves on sterile shoots, oblong-elliptic or oblong-lanceolate, (4)4.5–7.5(9) cm long, (1)1.5–3 cm wide. Terminal peduncles 5, glabrous to more or less densely ciliate, 2–7.5 cm long, hardly elongating in fruit, 3-branched at apex, then bifurcate, spreading; leaves of involucre ovate-lanceolate or lanceolate-triangular, 3.5–6.6(7) cm long, 1.4–3.3 cm wide; leaves of involucels ovate-triangular or deltoid-acute, the lower 3, 2.7–5 cm long, 1.5–3.3 cm wide, the upper 2 smaller; cyathium broadly campanulate, 4(5) mm in diameter, glabrous or sparingly pubescent outside, more or less pubescent inside, lobes large, ciliate at margin; styles 3–4 mm long; schizocarp 6–7 mm long, 7–8 mm wide, usually more or less ciliate; seeds ca. 3 mm long, brown. Fl. May. (Plate XVIII, Figure 3.)

Dry slopes. — E. Siberia: Dau. Gen. distr.: Mong. (N. Mongolia).
Described from Dauria. Type in Leningrad.

10. E. komaroviana Prokh. sp. nova in Addenda XIII, 734. —
E. Pallasii auct.; Kom., Fl. Man'chzh. II (1904) 686, non Turcz. —
Tithymalus Komarovianus Prokh. nomen altern.

344 Perennial plants, 8–35(50) cm high (only 5–8 cm high at anthesis with leaves still undeveloped), glabrous or pubescent; root thick (4–7 cm), branching; stems 5–28(43) cm high, 3–6 mm thick, with upper internode 2–9(13) cm long; basal leaves squamiform, persistent; lower cauline leaves alternate, the upper in whorls of 5 or 4, sessile, ovate-elliptic or oblong, (2)3–8.5 cm long, (0.8)1.2–2(3.3) cm wide, recurved at margin; leaves of sterile shoots alternate, cuneate at base, oblanceolate, 3.5–7 cm long, 1.2–1.7 cm wide. Terminal peduncles 5, glabrous or ciliate, sometimes densely so (at anthesis 1.5–5 cm long, elongating in fruit up to 5–13 cm), 3-branched, then sometimes bifurcate, close together at anthesis, more or less spreading in fruit; leaves of involucre ovate or lanceolate, (2.5)3–7.5(8) cm long, 1.4–2.5(4) cm wide; leaves of involucels slightly cordate at base, triangular-deltoid, the lower 3, 2.2–4.5 cm long, 2–3.5(4.5) cm wide, acute; cyathium subglobular, glabrous outside, 4–5 mm in diameter, with large lobes (1.5–2 mm); nectaries pubescent outside; styles ca. 1.5 mm long; schizocarp globulose-ovoid, 6–7 mm long, ciliate or glabrous, with thick pericarp and finely rugose cocci; seeds compressed-ovate, 3–4 mm long, smooth, with globular conical appendage, furrowed at inner surface. Fl. second half of April – second half of May, Fr. May. (Plate XVIII, Figure 2.)

Mountain forests. — Far East: Uss. Gen. distr.: Manchuria. Described from Sedanka station on outskirts of Vladivostok. Type in Leningrad.

Series 2. *Blepharophyllae* Prokh. — See Key on p.311 for characteristics of the series. Type: *E. blepharophylla* C.A.M. ex Ldb.

Represented by 4 species in Soviet Central Asia and several in China.

11. *E. rapulum* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 448, Ldb. Fl. Ross. III, 561; Boiss. in DC. Prodr. XV, 2, 115; Prokh. in Izv. Akad. Nauk SSSR (1927) 202; Kryl., Fl. Zap. Sib. VIII, 1865. — *Tithymalus rapulum* (Kar. et Kir.) Kl. et Gke. ex Klotzsch. in Abh. Akad. Berl. 1859 (1860) 67, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 73. — Ic.: Boiss. Ic. Euph. tab.63; Prokh. l. c. tabl.16. — Exs.: H. F. A. M. No.303.

345 Perennial plants, up to 20 cm high (rarely up to 35 cm), with underground globular, sometimes branching tuber; stems erect, rather thick below, distinctly attenuate above, spreading-branching, bearing axillary peduncles, without sterile branches; basal leaves ovate, sheathed; cauline leaves hardly petiolate or sessile, tapering and sometimes cordate at base, lanceolate-elliptic or spatulate, 3–4.5 cm long, 1–2 cm wide, obtuse, entire, 1-nerved, glabrous or ciliate at margin. Inflorescence wide, paniculate; peduncles 2-branched at apex, only the upper sometimes 3-branched; terminal peduncles inconspicuous, 2–4, short, axillary peduncles fairly numerous, nearly spreading; leaves of involucre slightly smaller than the cauline; leaves of involucels 2, only very rarely 3 (in upper), linear-lanceolate or ovate, the lower 8–13 mm long, 3–6(10) mm wide; cyathium broadly campanulate, 2–3 mm in diameter, glabrous outside, hairy inside, lobes orbicular, more or less obtuse, densely ciliate at margin; nectaries reniform; styles 1–1.5 mm long, connate at base, bifid; schizocarp ovoid, 4.5–5.5 mm long, 4–5 mm wide, trisulcate, with nearly smooth orbicular cocci, glabrous, with thin pericarp; seeds compressed-oblong, smooth, rufous-brown, with conical short-stalked appendage, furrowed inside. Fl. April, Fr. May.

Steppe slopes and steppes. — Centr. Asia: Balkh. (S. and E.), T. Sh. (N.) Syr. D., Pam.-Al. (W.). Gen. distr.: Dzu.-Kash. (banks of Ili River west of Kuldja). Described from the eastern part of Lake Balkhash area between the Donsyk and Chulak rivers. Type in Leningrad.

12. *E. blepharophylla* C.A.M. ex Ldb. Ic. pl. Fl. Ross. IV (1833) 24; Ldb. Fl. alt. IV, 188; Fl. Ross. III, 563; Boiss. in DC. Prodr. XV, 2, 114; Prokh. in Izv. Akad. Nauk SSSR (1927) 202; Kryl., Fl. Zap. Sib. VIII, 1868. — *Tithymalus blepharophyllus* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. (1859–1860) 73, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 75. — IC.: Ldb. Ic. pl. Fl. Ross. tab. 387; Prokh. l. c. tabl. 17.

Perennial plants, bright glaucous, with fusiform tuber, up to 4 cm thick; stems few, erect, 25–40 cm high, 10–15 mm thick, glabrous, without sterile branches, only with axillary peduncles above; basal leaves rather large, sheathed, long persistent; cauline leaves imbricately overlapping each other, subsessile, broadly ovate, 3–5.5 cm long, 2–4 cm wide, obtuse, entire, ciliate at margin, coriaceous, with 1 broad nerve, cordate and amplexicaul at base. Terminal peduncles 5, like the axillary 3-branched, then often

bifurcate; leaves of involucre like the cauline in shape but smaller; leaves of involucels small (not more than twice as long as cyathium), elliptic, distinctly longer than wide, the lower 3, the upper 2; cyathium broadly campanulate, 3–4 mm in diameter, hairy inside and out, lobes broadly ovate, obtuse, densely ciliate at margin; nectaries reniform, impressed at upper surface; styles ca. 1.5 mm long, connate only at base, 2-lobed; schizocarp flattened-ovoid, 5–6 mm long, deeply trisulcate, with smooth orbicular cocci; seeds compressed-oblong, ca. 4 mm long, smooth, brown, with obtuse conical short-stalked appendage. 346

Fl. second half of April – first half of May, Fr. May.

Stony slopes. – W. Siberia: Alt. (Ashutas Mountain, Chiganchii on Kaldzhir River); Centr. Asia: Balkh. (to the east: Arkaul and Dolonkara mountains, natural boundary of Dzhus-Agach). Endemic? Described from Kurchum River in Arkaul and Dolonkara mountains. Type in Leningrad.

Note. See *E. rupestris* Ldb. on p. 262.

13. *E. ferganensis* B. Fedtsch in O. and B. Fedch., Perech. r. Turk. VI (1916) 304. – *Tithymalus ferganensis* (B. Fedtsch.) Prokh., Obz. moloch. Sr. Azii (1933) 77, nomen altern. – Ic.: Prokh. l. c. tabl. 18.

Perennial plants with large fusiform tuber; stems solitary, erect, 30–75 cm high, rounded, thick (up to 3 cm), thinner towards base, densely villous with short recurved hairs, strongly branching, lower branches sterile, often exceeding inflorescence, upper branches fertile; basal leaves rather large, sheathed, usually deciduous; cauline leaves sessile, slightly cordate at base, broadly ovate or orbicular-oblong, (4)5–7 cm long, (2)3–4 cm wide, widest in the lower part, obtuse, subglabrous, densely ciliate only at margin, coriaceous, grayish-glaucous, often reddish, with broad prominent midrib; leaves of sterile branches alternate or sometimes opposite, cordate at base, elliptic or lanceolate, 3–7 cm long, 1–4 cm wide, obtuse or mucronate. Inflorescence corymbiform-paniculate, composed of many cymose umbels, one on terminal peduncle, the others on axillary ones (ca. 7–8 cm long); terminal peduncles of cymose umbels 3–5, pubescent, 3–5 cm long, 3-branched, then bifurcate; involucral leaves of cymose umbels rhombic-ovate or oblong-orbicular, 4–5 cm long, 3–4 cm wide; leaves of involucels often reddish, more than twice as long as cyathia, short-cuneate at base, broadly ovate-rhombic or flabelliform, obtuse or short-mucronate, usually the median 3, the upper 2; cyathium campanulate, 3.5–4.5 mm in diameter, pubescent on both sides, lobes orbicular (ca. 1 mm in diameter), long-ciliate at margin; nectaries reniform, impressed at upper surface; styles 1.5–2 mm long, connate below, bifid; schizocarp flattened-ovoid, ca. 8 mm long, 9–10 mm wide, trisulcate, usually with nearly smooth cocci, more or less pubescent; seeds compressed-oblong, 5–6 mm long, smooth, grayish, with obtuse conical rufous-brown white-dotted short-stalked appendage. Fl. April, Fr. June.

Dry barren slopes. – Centr. Asia: T. Sh. (west of Chotkal-Tau, Talass Ala-Tau, Kirghiz and Fergana ranges), Pam.-Al. (NE). Endemic. 347 Described from Namangan District, near Aivek ravine on Pashaata River. Type in Leningrad.

Note. In addition to its unique morphology, especially the compound inflorescence composed of many cymose umbels, the species is also of biological interest as a type of "tumbleweed."

14. *E. lipskyi* Prokh. Obz. moloch. Sr. Azii (1933) 80.— *Tithymalus Lipskyi* Prokh. *ibid.* nomen altern.

Perennial plants with rather small (ca. 5 cm long, 4 cm wide) orbicular-fusiform tuber; stems solitary, erect, 30–50 cm high, rounded, only 5–10 mm thick, slightly narrowing below, densely white-lanate with spreading hairs, branching above, lower branches sterile, growing nearly up to the level of inflorescence, upper branches fertile; basal leaves rather large, sheathed, oblong, brown; cauline leaves alternate, rounded or slightly cordate at base, subamplexicaul, oblong-lanceolate or triangular-ovate, 3.4–5 cm long, 1.6–2.5 cm wide, widest in the lower part, obtuse, entire, densely white-hairy at margin, glabrous above, early glabrescent beneath, grayish-green, scarious, with 1 broad distinct nerve; leaves of sterile branches alternate or sometimes opposite, rounded at base, elliptic-lanceolate, 3.5–6 cm long, 1–2.5 cm wide. Inflorescence paniculate, composed of several cymose umbels; terminal peduncles 3–5 in the cymose umbels, usually pubescent, 2.5–8 cm long, like axillary peduncles 3–(4)-branched, with secondary branches simple or rarely bifurcate; leaves of involucre triangular-ovate, 2.5–4 cm long, 2–3 cm wide; leaves of involucels nearly twice as long as cyathia, cordate at base, triangular-reniform, (0.8)1.9–3 cm long, (0.8)2–3.5 cm wide, obtuse or short-mucronate, overlapping at base, the lower 3–4, the upper 2; cyathium broadly campanulate, 4–5 mm in diameter, glabrous or hardly pubescent, lobes orbicular (ca. 1 mm long), long-ciliate at margin; nectaries reniform, impressed at upper surface; styles 1.5–2 mm long, connate below, 2-lobed; schizocarp flattened-ovoid, 5–6 mm long, 6–7 mm wide, trisulcate, with nearly smooth cocci, glabrous; seeds compressed-ovate, 4–5 mm long, smooth, grayish, with flattened whitish short-stalked appendage. April. (Plate XVIII, Figure 1.)

Mountain slopes.— Centr. Asia: Pam.-Al. (west: Bausun-Tag Mountains, the vicinity of Kulyab, Dzhalga). Endemic. Described from Baisun-Tag Mountains north of the Khodzha-Asmyn mountain pass. Type in Leningrad.

Section 3. *TULOCARPA* (Rafin.) Prokh. sect. comb. nova.— Subsect. *Galarhoei* Boiss. in DC. Prodr. XV, 2 (1862) 113, p. p.; Fl. or. IV, 1084, 1095.— Gen. *Tithymali* subgen. *Tulocarpa* Rafin. Fl. tellur. IV (1838) 115.— Gen. *Tithymali* subgen. *Tuloisia* Rafin. *ibid.*— Gen. *Tithymali* subgen. *Pythiusa* Rafin. l. c. 116.— Gen. *Tithymali* subgen. *Acrochordonocarpus* Prokh., Obz. moloch. Sr. Azii (1933) 81.— Gen. *Tithymali* sect. *Tulocarpa* Prokh. l. c. 94, ampl.— Gen. *Galarhoei* sect. *Tulocarpus* Prokh., in Trud. Kuibyskh. Bot. Sada (1941) 18.— For characteristics of the section see Key on p. 59. Type: *E. palustris* L.

Note. This is an extensive but rather natural section; in addition to the typical processes on the fruits it is also distinguished by the occurrence of a small but distinct calyx-shaped perianth above the peduncle at

the base of the schizocarp, and by the brown color of the seeds. Many species are distinguished by the apically 3-branched peduncles and trifoliate involuclers, others by the complete number of 5 nectaries — characters that are considered primitive in this case.

Beside subsection *Helioscopiae* with its typical seeds, the section is further divided here into two prominent subsections which are not distinctly defined owing to the occurrence of transitions between them. They are characterized by the color of the plant and the structure of the styles.

The series of vicariousness here is not always easily marked.

Subsection 1. *LUTESCENTES* Prokh. subsect. nova in Addenda XIII, 735. — Styles connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed and usually dilated at apex; leaves of involuclers and sometimes of the involucre generally more or less yellowish. Type of subsection: *Euphorbia pilosa* L.

15. *E. scripta* Somm. et Lev. in Tr. B. S. XII (1892) 159. — *Tithymalus scriptus* (Somm. et Lev.) Prokh. comb. nova, nomen altern.

Perennial plants 30–48 cm high, more or less hairy; root cylindrical, descending, multicapital; stems numerous, erect, slightly oblique at base, 2–4 mm in diameter), hollow, sparsely spreading-hairy, more densely so at nodes, sometimes subglabrous, striped, dark above, densely leafy, simple, sometimes with 1–2 short (5–10 mm) axillary peduncles above; basal leaves sheathed, squamiform, almost ovate, persistent; cauline leaves spreading or recurved below, sessile, tapering at base, elliptic-oblong or oblanceolate, 2.7–4.5 cm long, 9–15 mm wide ($2\frac{1}{2}$ to 4 times longer than wide), widest above middle, acute or obtuse, slightly crenate or subentire, scarious, paler beneath, sparsely hairy, more densely so at base and along margin. Terminal peduncles (3)5(6), simple, 4–7 mm long; leaves of involucre and the
349 approximate upper cauline leaves oblong-elliptic, 1.4–3 cm long, 4–12 mm wide (2 to 3 times longer than wide), acute; leaves of involuclers 2, broadly elliptic, 7–12 mm long, 3–7 mm wide ($1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide), obtuse, glabrous, sometimes yellowish; cyathium broadly campanulate, 2.5–3 mm long, 3–4.5 mm in diameter, glabrous, lobes large (1–1.5 mm), orbicular, obtuse, crenate and ciliate; nectaries 5, small, transversely elliptic, villous; bracts of staminate flowers long, villous; styles 2–3 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, 2-lobed, capitate above; schizocarp short-stalked, erect, globulose, 5–6 mm in diameter, trisulcate, with long attenuate-cylindrical apically hamate processes; compressed-conical at base; seeds compressed-ovate, ca. 2.5 mm long, 2 mm wide, dark brown, irregularly netted with thin wrinkles, with small reniform, hardly stalked appendage. Fr. August.

Alpine meadows at 1,800–2,300 m. — Caucasus: W. Transc. (Svanetia). Endemic. Described from Svanetia, from Utbiri Range between the Nakra and Nenskra rivers. Type in Florence.

Note. The reticular-rugose seeds and the strongly reduced terminal umbel are remarkable characters of this taxon.

16. *E. squamosa* Willd. Sp. pl. II (1799) 918. — *E. aspera* M. B. Fl. taur.-cauc. I (1808) 377 et III, 328; Ldb. Fl. Ross. III, 566; Boiss. in DC. Prodr. XV, 124; Fl. or. IV, 1101. — *E. muricata* M. B. Fl. taur.-cauc. I (1808) 837. — *E. abchazica* Woron. in Vestn. Tifl. Bot.

Sada, XXII (1912) 3. — *Tithymalus squamosus* (Willd.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 78, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 74. — Exs.: Pl. or. exs. No. 391.

350 Perennial plants, (27)40–80 cm high; root nodosely thickened, branching; stems hairy, rarely glabrous, with (2)4–14 thin axillary peduncles in upper part, 2–5(7.5) cm long, without sterile branches, internodes (1)2–3.5 cm long; basal leaves deciduous; cauline leaves with 2–8(20) mm long petioles, rounded or slightly attenuate at base, oblong or oblong-elliptic, 4.2–9(11.5) cm long, (1.2)2–3.7(4.7) cm wide, acute, entire or obscurely undulant, appressed-villous, often tomentose and generally prominent-veined beneath, lower cauline leaves obtuse. Terminal peduncles 5–8, thin, 2–6(9) cm long, like axillary peduncles twice or rarely thrice forked at apex; leaves of involucre elliptic-rhombic or orbicular-rhombic, 1.5–6.5 cm long, 0.8–2(2.8) cm wide, obtuse or rounded at apex, sometimes mucronate, more or less pubescent beneath; leaves of involucels 2, slightly cordate at base, triangular-ovate or reniform-deltoid, obtuse, glabrous, more or less yellowish, the lower 0.7–2.5 cm long, 1.1–2.5 cm wide, the upper reduced, always triangular-reniform (wider than long); cyathium short-turbinate, 2.5 mm in diameter, hirsute inside, lobes large (1–1.5 mm long), obtuse, oblong-orbicular, slightly dentate, glabrous; nectaries 4, transversely oblong, more or less stalked; styles (1.5)2–4 mm long, connate below (sometimes up to half their length), finely verrucose, 2-lobed; schizocarp long-stalked, short-ovoid or globulose, trisulcate, readily splitting, with crisp filiform-cylindrical processes pectinate-expanded at base, often in alternation with cilia; seeds oblong-ovate, glabrous, smooth, grayish-brown, with small flattened oblong-ovate short-stalked appendage slightly incurved. June. (Plate XX, Figure 5.)

Shrubby formations and forest edges. — Caucasus: Cisc., Dag., W., E. and S. Transc. Gen. distr.: As. Min. (E.). Described from Cappadocia (Asia Minor). Type was in Berlin.

17. *E. macrocarpa* Boiss. et Buhse in Nouv. Mém. Soc. Nat. Mosc. XII (1860) 197; Boiss. in DC. Prodr. XV, 2, 124; Fl. or. IV, 1101. — *Tithymalus macrocarpus* (Boiss. et Buhse) Prokh. comb. nova, nomen altern.

Perennial plants with soft spreading hairs; stems erect, the fertile 30–45 cm high, often also with shorter sterile stems, sulcate, thick, hollow, densely leafy, with axillary peduncles above; cauline leaves sessile, amplexicaul, oblong-lanceolate, 3.7–5 cm long, 1–1.8 cm wide, obtuse or acute, entire or hardly broadly incised, pale green, slightly paler beneath, cordate at base, slightly tapering. Terminal peduncles 5–7, short, ca. 3.7 cm long, like axillary peduncles simple or forked; leaves of involucels reniform-orbicular (wider than long), obtuse, rarely mucronate; cyathium short-turbinate, glabrous outside, short-hairy inside below nectary, lobes large, orbicular-ovate, dentate and ciliate; nectaries transversely elliptic; styles connate at base, somewhat 2-lobed; schizocarp globulose, ca. 10 mm long and wide, slightly trisulcate, densely covered with yellowish cylindrical-filiform processes; seeds globular, lead-gray, smooth, without appendage.

Forests and shrubby formations. — Caucasus: Tal. Gen. distr.: Iran. (N.). Described from Iran, from mountains near Saman. Type in Geneva.

18. *E. transoxana* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 553.— *Tithymalus transoxanus* Prokh. l. c. nomen altern.; Obz. moloch. tabl. 24.

- 351 Perennial; stems erect, 40–65 cm high, usually more or less hairy, branching above, bearing axillary peduncles and sterile lower branches; basal leaves squamiform, deciduous; cauline leaves with rounded or slightly cordate base, spatulate-obovate or elliptic or lanceolate, 3.5–5.5 cm long, 1.5–2.7 cm wide, usually dilated above, obtuse or hardly cuspidate, subentire or slightly serrate, glabrous or sometimes hairy, 1-nerved, leaves on sterile branches oblanceolate-linear. Terminal peduncles 5.3–6.5 cm long, like the axillary simple or very rarely forked at apex; leaves of involucre lanceolate-elliptic or obovate, 1.8–5.3 cm long, 0.9–2.3 cm wide; leaves of involucels 3, rhombic-orbicular or broadly ovate, 0.8–2.6 cm long, 0.9–2.3 cm wide; cyathium narrowly campanulate, 3–4 mm in diameter, with small orbicular glabrous lobes; nectaries transversely elliptic; styles 2.5–3.5 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, 2-partite; schizocarp flattened-globulose, 5–6 mm in diameter, with elongate, curved filiform processes; seeds ovate, 3–4 mm long, nearly smooth, with ovate-conical short-stalked appendage. Fr. June—first half of July. (Plate XIX, Figure 3.)

Mountain slopes. — Centr. Asia: T. Sh. (only in the south — Fergana Range), Pam.-Al. Endemic. Described from Gissar Range, from Khush-Shamsed River atop of Kanyaz'. Type in Leningrad.

19. *E. mucronulata* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 554.— *Tithymalus mucronulatus* Prokh. l. c. nomen altern.; Obz. moloch. Sr. Azii, 88.— Ic.: Prokh., Obz. tabl. 22.

- Glabrous glaucous perennial plants, 15–30 cm high; root descending; stems few, more or less erect, 12–24 cm high, usually partly branching, with few axillary peduncles above, and sterile branches below; cauline leaves subsessile, rounded or slightly cordate at base, obovate-lanceolate or oblong-ovate, 1.3–2.7 cm long, 4–10 mm wide, usually more or less dilated above, abruptly short-mucronate, entire or very shallowly serrate, 1-nerved, leaves on sterile branches shorter, elliptic, obovate, serrate. Terminal peduncles 4–5, 3–5 cm, long, simple; leaves of involucre ovate-orbicular, 1.2–2 cm long, 0.8–1.3 cm wide, obtuse or mucronate, cartilaginous at margin, slightly serrate or subentire; leaves of involucels 2, orbicular-ovate or triangular-ovate, 9–16 mm long, 10–14 mm wide, mucronate; cyathium broadly campanulate, ca. 3 mm long, 4 mm in diameter, glabrous outside, tomentose inside, lobes distinct, orbicular, notched, ciliate; nectaries transversely elliptic; styles 3–4 mm long, half-connate; schizocarp flattened-globulose, ca. 6 mm long, ca. 8 mm wide, not sulcate, with numerous long filiform flexuous reddish processes. Fr. July.
- 352

Mountains. — Centr. Asia: Syr D. (Aktau Range). Endemic. Described from Babai-Togdar, Aktau Range near Tashkent. Type in Leningrad.

Note. Known thus far only from its original locality; in order to define its area more precisely the search for this rare species in adjacent places is desirable.

20. *E. kudrjashevii* (Pazij) Prokh. comb. nova.— *Galarhoeus Kudrjashevii* Pazij in Bot. Mat. Gerb. Inst. Bot. i Zool. Akad. Nauk UzSSR, XI (1948) 27.— *Tithymalus Kudrjashevii* (Pazij) Prokh. comb. nova, nomen altern.



PLATE XVIII. 1 — *Euphorbia lipskyi* Prokh.; 2 — *E. komaroviana* Prokh.; 3 — *E. pallasii* Turcz.

Perennial plants, up to 20 cm high, crisp-hairy; root multicapital; stems erect, slightly sulcate, densely leafy, simple; basal leaves squamiform, scarious, oblong, purple; cauline leaves subsessile, rounded at base, oblong-linear, 2–4.5 cm long, 2–4 mm wide, widest below middle, acute, entire, with distinct midrib. Terminal peduncles 3–6, simple; leaves of involucre similar to the cauline; leaves of involucels linear-lanceolate, 1.8–2.4 cm long; cyathium broadly campanulate, 3–4 mm wide, glabrous outside and inside, lobes ovate, obtuse, tomentose-ciliate and hairy outside; nectaries transversely elliptic; styles 3.8–4 mm long, half-connate, 2-lobed; schizocarp (unripe) globose, ca. 6 mm long, crisp-hairy, with numerous long-cylindrical processes (except for the upper quarter). June.

Mountain slopes in the alpine zone. — Centr. Asia: Pam.-Al. (Gissar Range, Besh-Nau Mountains). Endemic. Described from Besh-Nau Mountains in Gissar Range in the upper reaches of Kashka Darya River.

Note. This species is absent in the herbarium. Since in the description the number of leaves of the involucels (2 or 3) is missing, it is impossible to establish the definite relationship of this species. It appears to be related to *E. mucronulata*, with 2 leaves in the involucre; however, the possibility of a closer affinity to *E. transoxana*, having 3 leaves, cannot be ruled out.

21. *E. orientalis* L. Sp. pl. (1753) 460; Ldb. Fl. Ross. III, 566; Boiss. in DC. Prodr. XV, 2, 121; Fl. or. IV, 1100. — *E. notadenia* Boiss. Diagn. ser. 1, XII (1853) 111. — *E. artvinensis* Bornm. et Woron. in Vestn. Tifl. Bot. Sada, XXIII (1913) 3. — *Tithymalus orientalis* (L.) Hill, Hort. Kew. 172, 3, (1768) nomen altern. — Ic.: Boiss. Ic. Euph. tab. 72.

- 355 Perennial plants, (40)60–100 cm high, glabrous; stems fairly numerous, strong, (32)54–94 cm long, 3–6.5 mm thick below, rounded, longitudinally thin-sulcate, sometimes reddish, densely leafy, internodes 8 to 10 times shorter than leaves, with 3–14 axillary peduncles (2)3.5–8(12) cm long (rarely without them) above, always without sterile branches; basal leaves deciduous; cauline leaves (except the upper) sessile, lanceolate, 4.5–9 cm long, 5–17 mm wide, acuminate, the lower obtuse, slightly shorter, recurved, strict, entire or obscurely dentate above, with prominent white nerve below and pinnate venation. Terminal peduncles 5–8, 2.5–8(11) cm long, like the axillary ones 4-branched at apex; leaves of involucre and upper cauline leaves oblong-lanceolate, 2–3.5(4.5) cm long, 8–10(15) mm wide; leaves of involucels orbicular-ovate, short-mucronate, yellowish, the lower in whorls of 4, (1)1.2–1.5(2) cm long, (6)8–11(14) mm wide, the upper opposite, reduced; cyathium subglobose-turbinate, ca. 2.5 mm long, 3 mm in diameter, glabrous outside, villous inside, lobes oblong, truncate, ciliate; nectaries 4, transversely oblong (ca. 2.5 mm long), yellow; styles 4–4.5 mm long, half-connate, short to 2-lobed; schizocarp flattened-globose, 4.5–5.5 mm long, ca. 6 mm wide, trisulcate, sparsely ciliate, cocci with thin longitudinal dorsal furrow at middle and short compressed-conical lateral processes turned into wrinkles at base; seeds ovate, 2.5–3 mm long, lead-gray, with patelliform appendage. Fl. June–July (August), Fr. July–August.

Stony slopes and taluses, on gravel along streams, shrubby formations. — Caucasus: S. Transc. Gen. distr.: As. Min. (NE), Iran. (Elburz Mountains in north). Described from the Near East. Type in London.

22. *E. palustris* L. Sp. pl. (1753) 462; Ldb. Fl. Ross. III, 568; Boiss. in DC. Prodr. XV, 2, 121; Fl. or. IV, 1100; Korsh. Tent. Fl. Ross. or. 375; Hegi, III, Fl. V, 1, 150; Krisht. in Fl. Yugo-Vost. V, 664. — *Tithymalus paluster* (L.) Garsault, Fig. Pl. Anim. Med. (1764) tab. 592; Descr. Pl. Anim. (1767) 345, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 101. — *Galarhoeus paluster* (L.) Haw. Syn. pl. succ. (1812) 45; Prokh. in Trud. Kuibysk. Bot. Sada, I, 18, olim. — Ic.: Rchb. Pl. crit. II, tab. 146 (fr.); Ic. Fl. Germ. V, tab. 189, f. 4771; Hegi, III, Fl. V, 1, f. 1760; Prokh., Obz. moloch. tabl. 27. — Exs.: G.R.F. No. 788; Pl. Finl. exs. No. 797.

Perennial plants, 60–150 cm high, glabrous, glaucous, often reddening; root cylindrical, thickened beneath stems; stems few, erect, hollow, early glabrescent below, 7–14 mm thick at base, attenuate above, strongly branching, bearing 1–5 axillary peduncles 4–7 cm long, with many sterile branches below, the longer sometimes exceeding inflorescence; lower cauline leaves spatulate-oblong, the others rhombic-elliptic or obovate, dilated in one place, all leaves 2–6(7) cm long, (5)8–23 mm wide, usually obtuse, subsessile, cartilaginous at margin, entire or hardly serrate at apex; lower leaves on sterile branches rhombic-spatulate, obtuse or even rounded, the others rather elongate, linear-lanceolate or linear-oblong, acute or rarely obtuse, all 2–8.3 cm long, 4–14 mm wide, cuneate below, entire, usually shallowly serrate only at apex. Terminal peduncles 5–8, unequal (3–5 cm), like axillary peduncles with 2–4(5) secondary peduncles at end, usually forked once or twice again; leaves of involucre, like upper cauline leaves (under peduncles) ovate or elliptic or obovate, 1.6–4(5) cm long, 1–2.2(2.3) cm wide, usually obtuse and entire; leaves of involucels elliptic or orbicular (the lower 1.1–1.8 cm long, 1–1.6 cm wide), obtuse, more or less yellowish; cyathium broadly campanulate, 3–3.5 mm long, 3.5–4.5 mm in diameter, glabrous outside, hairy inside, with orbicular dentate lobes; nectaries transversely oblong; styles 1–2 mm long, connate below, deeply bifid; schizocarp napiform, 4.5–5 mm long, 6–7 mm wide, flattened, deeply trisulcate, cocci with numerous short-cylindrical obtuse dorsal processes, glabrous; seeds ovate, 3–4 mm long, ca. 2.5 mm wide, smooth, brown, with small obtuse conical sessile appendage. Second half of May – first half of July, Fr. July. (Plate XIX, Figure 5.)

Inundated meadows. — European part: Lad. Ilm., U. V., V.-Kama, U. Dnp., M. Dnp., V.-Don, Transv. (SW), Bl., Crim., L. Don, L. V.; Caucasus: Cisc.? W. Transc.; W. Siberia: U. Tob. (W.). Gen. distr.: Scand. (S.), Centr. and Atl. Eur., Bal.-As. Min. Described from S. Sweden. Type in London.

23. *E. eugeniae* Prokh. sp. nova in Addenda XIII, 735. — *Tithymalus Eugeniae* Prokh. nomen altern.

Perennial glabrous plants, 40–65 cm high; stems erect, simple below, 4–6 mm in diameter, ribbed-stripped, strongly branching above, usually bearing few axillary peduncles 3–5 cm long, with many sterile leafy branches 10–16 cm long sometimes exceeding inflorescence; cauline leaves sessile,

short-cuneate at base, oblong-ob lanceolate or oblong-elliptic, 3.5–7(8) cm long, 1–2.2 cm wide (usually 3 to 5 times longer than wide), widest at the middle, rounded or obtuse at apex, entire, scarious, 1-nerved, leaves on sterile branches 1.5–4.3 cm long, 0.5–1.1 cm wide. Terminal peduncles not particularly noticeable, 3(5), thin, 1.5–3.5 cm long, like axillary peduncles 3-branched or bifurcate, sometimes forked once again; leaves of involucre 357 rhombic-obovate, 1–2.5 cm long, 9–13 mm wide, obtuse; leaves of involucels 3 or often 2, elliptic, 10–17 cm long, 4–6(11) mm wide (usually $1\frac{1}{2}$ times longer than wide); cyathium campanulate, 2–2.5 mm long and broad, glabrous, hairy inside, lobes orbicular (1 mm in diameter), obtuse, glabrous; nectaries 1, transversely elliptic, yellow; styles 1–1.5 mm long, nearly half-connate, thickly 2-lobed; schizocarp flattened-globulose, 3–3.5 mm long, 3.5–4.5 mm wide, shallowly trisulcate, glabrous, cocci with sparse rather long flattened conical dorsal processes; seeds compressed-ovate, 2.2–2.5 mm long, 1.7–2 mm wide, smooth, glossy, dark brown, with small convex-reniform short-stalked appendage. Fl. June–July, Fr. August. (Plate XIX, Figure 2.)

Subalpine meadows. — Caucasus: W. Transc. Endemic. Described from Abkhazia, from Achishkho Mountain near Krasnaya Polyana. Type in Leningrad.

24. *E. carpatica* Woloszcz. in Sprawozd. Kom. Fisyogr. XXVII (1892) 153; Pilat in B. B. C. LIV (1935) 337. — Ic.: Pilat, l. c. tab. VI, f. 1–3. — Exs.: Fl. exs. Boh.-Slov. No. 912.

Perennial plants, 45–170 cm high, caespitose; root thick (1.5–2.5 cm), woody, irregularly branching; stems erect, thick (7–10 mm below, 6–8 mm at middle), ribbed-stripped, nearly hollow, slightly constricted, sometimes glabrous (especially below), sometimes with sparse easily deciduous thin white spreading hairs (0.5–1 mm long), leafless in lower third, more or less dark colored and leafy above, branching above into elongate axillary peduncles and sterile branches under them; cauline leaves many, sessile or hardly petiolate, oblong-spatulate or oblong-lanceolate, 4.5–7.5 cm long, 1.4–2.6(3.5) cm wide ($2\frac{1}{2}$ to 4 times longer than wide), widest in upper third, more or less obtuse, narrowly hyaline-margined, especially near apex, shallowly but distinctly acutely serrate, scarious, sparingly pubescent or subglabrous above, a little more densely hairy beneath, especially along veins, long-cuneate at base, sometimes slightly orbicular below. Inflorescence corymbiform-paniculate; terminal peduncles, usually inconspicuous, like axillary peduncles 2-(3)-branched at apex; leaves of involucre, like upper cauline leaves, short-obovate or ovate-orbicular, nearly as long as the corresponding peduncles, pale green, slightly yellowish, otherwise like cauline leaves; leaves of involucels elliptic or obovate or ovate ($1\frac{1}{2}$ to 2 times longer than wide), pale green, only slightly yellowish, not shorter than peduncles, obtuse, margin like cauline leaves, the lower 12–20 mm long, 7–11 mm wide; cyathium campanulate-turbinate, glabrous outside, lobes large (1–1.5 mm), long-white-hairy inside and on lobes; nectaries trans- 358 versely elliptic, entire, yellowish; schizocarp globulose, 4–5 mm long, 4.5–5 mm wide, trisulcate, green, with thick processlike crests more than 1 mm long, always — especially in upper part — sparsely set with sessile long (longer than crests) declinate white thin hairs; seeds ovate-globular, 2.3–2.5 mm long, smooth, glossy, brownish-gray, with small flat reniform whitish appendage. (June) July.

Edges of mountain forests and shrubby slopes in the subalpine belt at elevation of 700–1,700 m. — European part: U. Dns. (E. Carpathians). **Gen. distr.:** Centr. Eur. (SW. Poland and N. Transylvania). Endemic in E. Carpathians. Described from Lomnice Peak. Type in Lvov.

Note. Closely related to *E. austriaca* Kern. growing in the eastern Alps and to the Crimean *E. tauricola* Prokh. from which it essentially differs only by quantitative characters.

25. *E. tauricola* Prokh. sp. nova in Addenda XIII, 736. — *E. pilosa* auct.; M. B. Fl. taur.-cauc. III (1819) 328, syn. excl. non L.; Boiss. Fl. or. IV, 1096, p. p. — *Tithymalus tauricola* Prokh. nomen altern.

Perennial plants, 30–80 cm high; root descending, thick (2–3 cm), multicipital; stems rather numerous, erect, 30–75 cm high, 3–5 mm in diameter at base, ribbed-striate, glabrous, dark purple and more or less branching above, bearing 2–8 axillary peduncles (1) 1.8–7.5 cm long, and often under them 2–5 sterile branches 0.5–4 cm long, not exceeding inflorescence, sometimes completely absent, sparsely leafy, with solitary leaf scars, internodes 0.5–2 cm long, glabrous below; basal leaves squamiform, sheathed, triangular; cauline leaves hardly petiolate, elliptic or oblong-elliptic, rounded slightly cordate at base, 3.3–6 cm long, 1.4–2.5 cm wide, widest at middle, only 2 to 3 times longer than wide, obtuse, finely and acutely serrate at margin especially near apex, thin, pinnately veined, sparingly hairy above, becoming glabrous, sparsely hairy beneath especially along margin and veins. Terminal peduncles 5, 1.5–3.5 cm long, like axillary peduncles 3-branched then bifurcate; leaves of involucre orbicular-oblong, 1.5–2.6 cm long, 1.1–1.7 cm wide; leaves of involucels orbicular-elliptic or orbicular-obovate or sometimes completely orbicular, obtuse, glabrous, yellowish at anthesis, rounded at base, the lower 3 in number, 1.1–1.6 cm long, 0.8–1.5 cm wide, the terminal 2, reduced; cyathium campanulate, 2.5–3 mm long and broad, glabrous outside, villous inside, with oblong obtuse glabrous lobes; nectaries 4, transversely elliptic, yellowish; styles (1.5) 2–2.5 mm long, connate at base, bifid; schizocarp flattened-globulose, 4–4.5 mm long, 4.5–5 mm wide, trisulcate, rather smooth, densely long spreading-ciliate when young, gradually becoming glabrous in maturity, rapidly splitting; seeds ovate, smooth, with inconspicuous disciform appendage. Fl. second half of April–May, Fr. June–July. (Plate XIX, Figure 4).

Mountain slopes, shrubby formations and forest edges. — European part: Crim. Endemic. Described from Belbek in the Crimea. Type in Leningrad.

26. *E. villosa* Waldst. et Kit. Pl. rar. Hung. I (1802) 96; Syreishch., Ill. Fl. Mosk. gub. II, 339; Hegi, Ill. Fl. V, 1, 148. — *E. pilosa* auct.; Neilr. Fl. v. Nied. Oesterr. (1859) 846; Boiss. in DC. Prodr. XV, 2, 116; p. p.; Fl. or. IV, 1096, non L. (1753). — *E. procera* M. B. Fl. taur.-cauc. I (1808) 378, et III, 329; Ldb. Fl. Ross. III, 564. — *Tithymalus villosus* (Waldst. et Kit) Pasher, Fl. v. Kärnten (1887) 233, nomen altern. — Ic.: Waldst. et Kit. l. c. tab. 93 (flowers); Rchb. Pl. crit. II, tab. 145 et Ic. Fl. Germ. V, tab. 138, f. 4770; Syreishch., l. c. 339; Hegi, Ill. Fl. V, 1, f. 1759. — Exs.: Fl. exs. austro-hung. No. 866.

Perennial plants, 45–100(120) cm high, densely pubescent; root thick-cylindrical, multicipital, with long suckers; stems numerous, erect, 4–7 mm thick below, hollow, ribbed-striate, more or less villous, sometimes partly

glabrous or lanate, strongly branching, bearing 2–10 axillary peduncles (1.5–11 cm long) and with lower sterile branches, sometimes later exceeding inflorescence; basal leaves squamiform; cauline leaves sessile or hardly petiolate, tapering at base, oblong-lanceolate, 4.5–10.3(11.5) cm long, 9–25 mm wide (the upper reduced, oblong-ovate), obtuse, finely serrate at apex and along the cartilaginous margin, glabrous above or short-pubescent at tip, soft-hairy beneath. Inflorescence corymbiform, terminal peduncles 5–8, 1.5–7 cm long, like axillary peduncles 3-branched and then bifurcate; leaves of involucre (and also of upper cauline) truncate at base, broadly ovate or oblong-lanceolate, 1.7–4.6 cm long, 7–17 mm wide, rounded, rarely acuminate, at first yellowish-green; leaves of involucels rounded at base, oblong-elliptic, obtuse, yellowish, glabrous or sometimes more or less hairy at base, the lower in number 3, 9–20 mm long, 6–13 mm wide, the terminal 2, reduced; cyathium campanulate, ca. 2.5 mm long, 2.5–3 mm in diameter, with orbicular-ovate dentate-fimbriate lobes; nectaries 4, transversely elliptic, yellowish, later red-yellow; styles 1–1.5 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed; schizocarp flattened-globulose, 3.5–4 mm long, 4–4.5 mm wide, slightly sulcate, sparingly pubescent or glabrous; seeds compressed-ovate, 2–2.5 mm long, smooth or with scattered suborbicular tubercles, dark brown, shining, with sessile reniform appendage. May–June.

Damp meadows, swampy river valleys, shrubby formations on riverbanks, ditches and forest plots, lowlands and foothills. — European part: M. Dnp., Bes.; Caucasus: Cisc., Dag., W., E. and S. Transc. Gen. distr.: Centr. and Atl. Eur., W. Med. (N.). Described from Hungary. Type in Vienna.

27. *E. semivillosa* Prokh., Obz. moloch. Sr. Azii (1933) 112; Kryl., Fl. Zap. Sib. VIII, 1868. — *E. desertorum* Weinm. in Bull. Soc. Nat. Mosc. X (1837) No. 7, p. 73, p. p. nomen confusum. — *E. procera* auct.; Ldb. Fl. Ross. III (1849–1851) 564; Korsh. Tent. Fl. Ross. or. 374; Krisht. in Fl. Yugo-Vost. V, 664, non M. B. (1808). — *E. pilosa* auct.; Boiss. in DC. Prodr. XV, 2 (1862) 116, non L. (1753). — *Tithymalus semivillosus* Prokh. l. c. nomen altern. — *Galarhoeus semivillosus* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 31, olim. — Ic.: Gmel. Fl. Sib. II (1749) 227, tab. 94; Prokh., Obz. moloch. tabl. 32. — Exs.: G. R. F. No. 2580 ("*E. procera* M. B. var *leiocarpa* Ldb.").

Perennial plants, 35–200 cm high; root cylindrical, thickened below stem; stems usually few, erect, up to 195 cm high, 3–7 mm thick below, glabrous, ribbed above, branching, bearing 1–11 axillary peduncles, 2–20 cm long, and with few usually short sterile branches rarely reaching inflorescence; cauline leaves (except for the upper) sessile or rarely hardly petiolate, more or less cordate at base and slightly amplexicaul or rarely somewhat cuneate, linear-lanceolate or oblong-lanceolate or oblanceolate or sublinear, (2)3.5–11 cm long, 6–20 mm wide, acute or rarely obtuse, cartilaginous at margin, finely serrate above middle, appressed-hairy or glabrous above, paler beneath and always, even if only at base, more or less pubescent, leaves on branches narrowly lanceolate, 1.6–6.3 cm long, 4–8 mm wide, usually acuminate. Terminal peduncles 3–8, 1–6 cm long, like axillary peduncles with 2–4 secondary peduncles, usually once or twice forked again; leaves of involucre like upper cauline leaves (under peduncles) ovate, or lanceolate or oblong-elliptic or rhombic-ovate, 1–4.5 cm long, 5–15 mm wide, obtuse, sometimes completely glabrous; leaves of involucels

361 ovate or obovate or orbicular-elliptic (the lower 7–20 mm long, 5–12 mm wide), obtuse or hardly cuspidate, yellowish at anthesis; cyathium campanulate, 2.5–3 mm long, 2.5–3.5 mm in diameter, glabrous outside, villous inside, lobes small, triangular-ovate, slightly ciliate; nectaries transversely oblong, yellowish; styles 1–1.5 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed; schizocarp flattened-globulose, 3–4 mm long, 3.5–4.5 mm wide; seeds ovate, 2.5–3 mm long, smooth, brown, with small obtuse conical short-stalked appendage. Fl. second half of May–July, Fr. second half of June–first half of August. (Plate XIX, Figure 1.)

Ravines in steppes, clayey and stony slopes, shrubby formations, forest edges and plots, groves and forest outliers, sometimes fallow land, rarely inundated meadows and solonchaks. — European part: U. V., V.-Kama (S.), V.-Don, Transv., Bl., Crim. (N.), L. Don; W. Siberia: U. Tob. (W.). Endemic. Described from Toguzak River near Verinskaya village. Type in Leningrad.

28. *E. aristata* Schmalh. in Ber. Deutsch. Bot. Ges. X (1892) 292; Shmal'g., Fl. II, 410. — *E. soongarica* auct.; Lipsky in Tr. B. S. XIII (1894) 336; Lipsky (p. p.) in Ö. B. Z. XLVIII, 1, non Boiss. (1860). — *Galarhoeus soongaricus* Prokh. in Tr. Kuibyshev. Bot. Sada, I, 21, p. p. non typ. — *Tithymalus aristatus* (Schmalh.) Prokh. comb. nova, nomen altern. — Ic.: Schmalh. l. c. (1892) tab. 17, f. 13 (leaf).

Perennial plants up to 1 m high, glabrous, glaucous; stems thick (10–11 mm at base and 6–7 mm at the middle), ribbed-striate, branching in upper part, bearing 7–12 axillary peduncles 2.5–7 cm long, with many leafy sterile branches, below, upper branches often long up to inflorescence and even longer; cauline leaves sessile or hardly petiolate, tapering at base, oblanceolate, 4.5–8 (11) cm long, 10–16 mm wide, cartilaginous at margin especially in upper part and finely and obtusely serrate, sometimes undulant, rather thin, ending in long (1–2 mm) mucro. Inflorescence corymbiform-paniculate; terminal peduncles 5, 1.5–3 cm long, more or less approximate in indistinct cymose umbel, like axillary peduncles branching into cymose umbels of 3–4 secondary peduncles (0.4–1.3 cm long), then again once bifurcate; leaves of involucre obovate, 14–15 mm long, 5–6 mm wide, abruptly mucronate; leaves of involucels orbicular-obovate, 7–9 mm long, 4–6 mm wide, obtuse or hardly cuspidate; cyathium campanulate, 2–2.5 mm long, 2.5–3 mm in diameter, glabrous outside, villous inside, with ovate obtuse lobes; nectaries transversely elliptic, obtuse, yellowish; styles 1.5–2 (2.5) mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed; schizocarp flattened-globulose, 4.5–5 mm long, slightly trisulcate, with small scattered tubercles, sometimes nearly smooth; seeds compressed-ovate, 3.5–4 mm long, 2.2–2.8 mm wide, brown, smooth, with rather distinct, obtuse conical, subsessile appendage. May.

Herbaceous slopes of the lower part of hills. — Caucasus: Cisc. (only near Stavropol in the vicinity of "Polkovnichii Yar"). Endemic. Described from N. Caucasus in the vicinity of Stavropol. Type in Kiev.

362 Although both Lipskii (Ö. B. Z. XLVII, 1) and myself (Tr. Kuibyshev. bot. sada, I, 21) have refuted the independent specific rank of this taxon, it should nevertheless be separated and recognized due to the long mucro of its leaves.

29. *E. soongarica* Boiss. Cent. Euph. (1860) 32, et in DC. Prodr. XV, 2, 121; Prokh. in Izv. Akad. Nauk SSSR (1927) 206; Kryl., Fl. Zap. Sib. VIII (1871); Lipsky (p. p.) in Ö.B.Z. XLVII, 1. — *E. palustris* var. β . C. A. M. ex Ldb. Fl. alt. IV (1833) 194. — *Tithymalus soongaricus* (Boiss.) Prokh., Obz. moloch. Sr. Azii (1933) 103, nomen altern. — *Galarhoeus songaricus* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 21, olim. — Ic.: Prokh., Obz. moloch. tabl. 28.

Perennial plants, 70–150 cm high, glabrous, glaucous; root oblique, cylindrical, thickened under stem; stems erect, ribbed above, branching, bearing 3–7 axillary peduncles, 3–4.5 cm long, and with numerous sterile branches underneath peduncles, upper branches usually exceeding inflorescence; cauline leaves (except for the upper) subsessile, cuneate at base, oblanceolate, 2–11 cm long, 5–22 mm wide, acuminate or abruptly mucronate or sometimes obtuse, serrate in upper part, leaves on sterile branches, linear-lanceolate, 3–4 cm long, 2.5–6 mm wide, strongly acuminate. Inflorescence corymbiform-paniculate; terminal pedicels 5–11, 2–3.5 cm long, like axillary peduncles usually with 3 secondary peduncles forked in turn; leaves of involucre, like upper cauline leaves (under peduncles) oblong-lanceolate, 1–3 cm long, 4–10 mm wide, subentire; leaves of involucels elliptic-obovate or orbicular-ovate, 4–10 mm long, 2–8 mm wide, subentire, yellowish; cyathium campanulate, ca. 2 mm long, 2.5–3.5 mm in diameter, glabrous outside, tomentose inside, with small orbicular ciliate lobes; nectaries transversely elliptic; styles (1)1.5–2(2.5) cm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed; schizocarp flattened-ovoid, 4–5 mm long and wide, faintly trisulcate, at first uninterruptedly verrucose on dorsal surface of cocci, later only sparsely tubercled; seeds compressed-ovate, 2.5–3 mm long, smooth, brown, with small convex-disciform appendage. Fl. June – first half of July, Fr. July – first half of August.

Damp solonchaks, ravines, and river valleys ("riparian woodlands"). — European part: Transv. (S.); W. Siberia: Alt. (W.); Centr. Asia: Balkh. (E.), Dzu.-Tarb. Gen. distr.: Dzu.-Kash. (Black Irtys River valley in the north), Mong. (lower reaches of Etsin-Gol River near Mulin Mountain in the south). Described from the natural boundary of Chingis-Tau. Type in Geneva.

30. *E. lamprocarpa* Prokh., Obz. moloch. Sr. Azii (1933) 105. — *E. soongarica* auct.; Lipsky in Ö.B.Z. XLVII (1897) 1, p. p. non typ. non Boiss, p. p. (1860). — *E. nuda* auct.; Prokh. in Izv. Akad. Nauk SSSR (1927) 205, p. p. non Vel. — *E. pilosa* auct.; B. Fedtsch. and O. et B. Fedch., Perech. r. Turk. (1916) 305, non L. (1753). — *Tithymalus lamprocarpus* Prokh., Obz. moloch. 105, nomen altern. — Ic.: Prokh. l. c. tabl. 29, 30, 31.

Perennial plants, 50–200 cm high, glabrous, glaucous; root descending, multicapital; stems erect, usually glabrous below, ribbed, branching above into erect or slightly curved axillary peduncles above (5–15 cm long), below with sterile branches often exceeding inflorescence; cauline leaves (except for the upper) short-petiolate, cuneate at base, oblanceolate, 4–10 cm long, 6–22 mm wide, widest above middle, abruptly cuspidate except for the truncate lower leaves, cartilaginous at margin, more or less serrate in upper part, rather thick, leaves on sterile branches narrower and more acutely

serrate. Inflorescence corymbiform-paniculate; terminal peduncles 4–6, inconspicuous; axillary peduncles, like the terminal, with 3–4 secondary peduncles, once or twice forked again (rarely 3-branched); leaves of involucre and upper cauline leaves (under peduncles) oblong-obovate or lanceolate-elliptic, 1–5 cm long, 0.4–1 cm wide; leaves of involucels usually cuneate at base, obovate or orbicular-elliptic, 5–12 mm long, 2–7 mm wide, obtuse, cartilaginous at margin, subentire or hardly crenate, yellowish; cyathium campanulate, 3–4 mm in diameter, glabrous outside, hairy inside, with orbicular ciliate lobes; nectaries transversely elliptic; styles (1) 1.5–2(2.5) mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, thickly 2-lobed; schizocarp flattened-globulose, 4–5 mm long and wide, trisulcate, cocci nearly smooth, rarely with individual inconspicuous verrucae; seeds compressed-ovate, ca. 3 mm long, smooth, brown, with small convex-disciform oblique sessile appendage. Fl. June–July, Fr. July – first half of August.

River valleys ("riparian woodlands") and stream banks, often among shrubby formations. — Centr. Asia: Balkh. (south of Lake Balkhash), Dzu.-Tarb. (south of Dzhungarian Ala-Tau), T. Sh., Syr D., Pam.-Al. Gen. distr.: Dzu.-Kash. (Kuldja district). Described from Belovodskoye near Chimkent. Type in Leningrad.

Note. The distribution area of this species is interrupted near the Turkestan, Zeravshan and Gissar ranges which are parallel to Zeravshan River and lie in between its main distribution area in Central Asia and its isolated area in SW Tadzhikistan.

31. *E. pilosa* L. Sp. pl. (1753) 460; Litv. in Trud. Bot. muz. Akad. Nauk, XV, 138; Kryl., Fl. Zap. Sib. VIII, 1871, non alius. — *E. lutescens* C.A.M. ex Ldb. Ic. pl. Fl. Ross. I (1829) 5; Fl. alt. IV, 194; Fl. Ross. III, 568; Boiss. in DC. Prodr. XV, 2, 124; Prokh. in Izv. Akad. Nauk SSSR (1927) 207. — *Tithymalus pilosus* (L.) Sco. Fl. carn. ed. 2, I (1772) 337, quoad nomen, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 84. — *Galarhoeus pilosus* Haw. Syn. pl. succ. (1812) 148. — Ic.: Gmel. Fl. Sib. II (1749) tab. 93; Ldb. Ic. pl. Fl. Ross. tab. 12; Prokh., Obz. moloch. tabl. 20.

Perennial plants, 30–80(100) cm high; root fusiform-tuberos; stems solitary or rarely 2–3, pubescent (especially above) with long spreading white hairs, branching above, bearing numerous axillary peduncles but without sterile branches; basal leaves squamiform, oblong, obtuse, brown; cauline leaves sessile, somewhat increasing upwards, dense, tapered or rounded at base, oblong-obovate, 3–12 mm long, 1–3.5 cm wide, widest above middle, obtuse except for the short-acuminate upper leaves, subentire, finely serrate at apex only, scarious, covered with spreading hairs especially beneath or when young, rarely subglabrous. Inflorescence corymbiform; terminal peduncles few, short, inconspicuous; axillary peduncles, like the terminal, 3-branched, then bifurcate; upper cauline leaves (sustending peduncles) and leaves of involucre yellow at anthesis, later usually becoming green; leaves of involucels small, elliptic or obovate, yellow at anthesis, the lower 3 in number, unequal, the upper small, usually 2; cyathium broadly campanulate, 4–5 mm in diameter, glabrous outside, lanate inside, lobes orbicular-ovate, obtuse, glabrous; nectaries transversely elliptic, golden yellow, later becoming brown; styles connate,

thickly 2-lobed; schizocarp globulose, ca. 4 mm in diameter, not sulcate, with dark red subulate-conical processes 1.5–2 mm long; seeds compressed-ovate, 2–2.5 mm long, smooth, dark brown, with oblique flattened subsessile appendage. May–June.

Forest edges and grass plots, subalpine meadows. — W. Siberia: Ob (SE), Irt. (E.), Alt.; E. Siberia: Yenisei (SW), Ang.-Say.; Centr. Asia: Dzu.-Tarb. (Tarbagatai Range). **Gen. distr.:** Mong. Described from W. Siberia between Irtysh and Yenisei. Type in London.

32. *E. polychroma* Kern. in Ö.B.Z. XXV (1875) 395; Hegi, Ill. Fl. V, 1, 153. — *E. epithymoides* auct.; Jacq. Fl. austr. IV (1776) 23, non L.; Ldb. Fl. Ross. III, 567; Boiss. in DC. Prodr. XV, 2, 125; Fl. or. IV, 1102, non L. (1753). — *Tithymalus polychromus* (Kern.) Prokh. comb. nova, nomen altern. — Ic.: Jacq. l. c. tab. 344; Rchb. Ic. Fl. Germ. V, tab. 136, f. 4764; Bot. Mag. tab. 2258; Hegi, Ill. Fl. V, 1, f. f. 1763, 1764. — Exs.: Fl. exs. Boh.-Slov. No. 241, 1004; Fl. Boh. et Morav. exs. No. 1049; Fl. Stir. exs. No. 455; Schultz, Herb. Norm. Nov. ser. No. 2682; Fl. exs. austro-hung. No. 43.

365 Perennial plants, (10)18–63 cm high; root short, thick, sturdy, multicapital; stems erect, not becoming woody, 3–5 mm thick, villous with soft white hairs, usually simple, sometimes with only 1 axillary peduncle above, rarely also with short sterile branches, never branching below, sparsely leafy; basal leaves squamiform, reddish; cauline leaves with 1–3 mm long petioles, tapering at base (upper leaves slightly cordate), oblong-obovate or oblong, 1.8–6.2 cm long, (0.5)1–2.5 cm wide, more or less obtuse, entire, soft-hairy, densely so beneath, sparsely above. Terminal peduncles crowded, (3)5, 0.3–8 cm long, shortly 3-branched then once again bifurcate; leaves of involucre ovate or oblong or obovate, (1.5)2–5.5 cm long, at first as long as rays, 0.8–2.6 cm wide, obtuse, more or less pubescent, pale yellow, orange at anthesis; leaves of involucels rounded or tapering at base, oblong-ovate or elliptic, obtuse or emarginate, glabrous, yellow at anthesis, the lower 3 in number, equal, (1.2)1.5–3.5 cm long, (0.5)0.9–2.1 cm wide, the terminal 2, reduced; cyathium campanulate, 1.5–2 mm long, 2–5.5 mm in diameter, scarious, glabrous, lobes equal, ovate, truncate to slightly emarginate; nectaries commonly 3 in number, transversely elliptic, waxy-yellow; styles 0.5–0.8 mm long, half-connate, thickly 2-lobed; schizocarp globulose-ovoid, ca. 4 mm long, 5 mm wide, somewhat flattened, faintly trisulcate, with twisted orange-yellow or purple filiform processes; seeds globular-ovate, compressed, 2.5–3 mm long, smooth or hardly rugose, with reniform verrucose-tuberculate appendage. May–June.

Stony slopes of hills in shrubby formations, forest edges, banks of streams, preferring calcareous soil. — European part: U. Dns., M. Dns. (W.), Bes. **Gen. distr.:** Centr. Eur., Bal. (N.). Described from Austria. Type in Vienna.

33. *E. carniolica* Jacq. Fl. austr. Append. (1778) 34; Boiss. in DC. Prodr. XV, 2, 128; Hegi, Ill. Fl. V, 1, 156. — *E. ambigua* Waldst. et Kit. Ic. pl. II (1805) tab. 135. — *Tithymalus carniolicus* (Jacq.) Rafin. Fl. tellur. IV (1838) 115, nomen altern.; Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 77. — Ic.: Jacq. l. c. tab. 14; Waldst. et

Kit. 1. c.; Rchb. Ic. Fl. Germ. V, tab. 134; f. 4760; Hegi, Ill. Fl. V, 1, f. 1767. — Exs.: Fl. exs., austro-hung. No. 497; Fl. Stiriaca exs. No. 456; Fl. Italica exs. No. 477. —

366 Perennial plants, (10)20–53 cm high, sparingly hairy; root woody, cylindrical, nearly horizontal above; rhizome angular and jointed, often beset with fine conical tubercles at upper side; stems erect, thin (2–4 mm), winged-ribbed, hairy, pale green often with purple tinge, bearing above, 1–5 axillary peduncles 2.7–5.5 cm long, without sterile branches, sparsely leafy (internodes 1–2 cm, the upper up to 7 cm long); basal leaves squamiform, up to 1–1.5 cm long, deciduous; cauline leaves with 2–5 mm long petioles, cuneate at base, oblong-oblancheolate, 2.7–6.5 cm long, 1–2.4 cm wide, more or less obtuse, sometimes emarginate, entire, scarious, pale or yellow-green (paler beneath), glabrous or hairy beneath. Terminal peduncles (3)5, drooping in flowering, 1.5–7.5 cm long, like axillary peduncles bifurcate; leaves of involucre sessile, oblong-elliptic or oblong-oblancheolate, (1.2)2.3–4.6 cm long, 1.2–2 cm wide, rounded or acuminate; leaves of involucels 2, short-petiolate, rounded or abruptly tapering at base, ovate-lanceolate or elliptic ($1\frac{1}{2}$ to 2 times longer than wide), slightly undulate at margin, greenish or golden yellow, the lower 1.4–5.7 cm long, 0.7–1.9 cm wide; cyathia on 5–8(15) mm long pedicels, turbinate, ca. 3–4 mm long and broad, yellow, outside sparsely long-ciliate, glabrous inside, with small ovate lobes; nectaries 5, transversely elliptic, brown-yellow, stalked; styles (1)1.5–2.5 mm long, connate below, 2-lobed; schizocarp flattened-ovoid, 4(5) mm long, ca. 6 mm wide, cocci with scattered thick subglobular processes at middle of their dorsal surface, glabrous or hairy; seeds oblong-ovate, ca. 4 mm long, smooth, lead-gray, with saucer-shaped appendage. April–June.

Mountain meadows, shrubby formations, broadleaved forest in glades from foothills to the subalpine belt (up to 1,900 m). — European part: U. Dns. (Bukovina). Gen. distr.: Centr. Eur. (S.), Bal. (N.). Described from Carniola. Type in Vienna.

34. *E. stricta* L. Syst. nat. ed. 10, II (1759) 1049; Ldb. Fl. Ross. III, 560; Boiss. in DC. Prodr. XV, 2, 123; Fl. or. IV, 1099; Hegi, Ill. Fl. V, 1, 161. — *E. micrantha* M. B. ex Willd. Sp. pl. II (1799) 905; M. B. Fl. taur.-cauc. I, 376, III, 327; Ldb. l. c. — *Tithymalus strictus* (L.) Kl. et Gke. ex Garcke, Fl. Deutschl. ed. 4 (1849) 290, nomen altern; Prokh., Obz. moloch. Sr. Azii, 115. — *Galarhoeus strictus* Haw. Syn. pl. succ. (1812) 151. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 133, f. 4757, 4756; Hegi, Ill. Fl. V, 1, f. f. 1770, 1771, 1772; Prokh. l. c. tabl. 33. — Exs.: G. R. F. No. 2578.

367 Annual plants, 15–65 cm high, glabrous or pubescent, dark green, with disagreeable odor; root fusiform, vertical; stems generally numerous, erect, rounded (2–5 mm thick), glabrous, yellow-green, sometimes reddish, usually simple below, rarely sparsely branching at base (often with 2 opposite branches), bearing above 2–20 thin axillary peduncles (1–8 cm long), only very rarely with short sterile branches below them; cauline leaves spreading recurved, short-petiolate (petioles 1 mm long) or sessile, the lower cuneate at base, oblong-obovate, obtuse, the upper cordate sometimes subamplexicaul at base and not strongly tapering, acute, 1.2–5.5 cm long,

0.3–1.5 cm wide, all leaves finely and irregularly serrate at upper part, glabrous or sparingly long-hairy, pale green, scarious. Inflorescence paniculate; terminal peduncles 3 or rarely 5, thin, 1–8 cm long, 3-branched or bifurcate, later twice to 4 times forked and, finally, often with terminal pseudo-bostryces (monochasa); axillary peduncles only once to 3 times forked, then ending with a bostryx; leaves of involucre oblong-elliptic or ovate, 8–35 mm long, 4–11 mm wide, serrate, acute, recurved; leaves of involucels truncate or slightly cordate at base, triangular-ovate or sub-orbicular-reniform, short-cuspidate or obtuse, serrate, the lower 3 or 2, varying in shape, resembling the leaves of involucre or the terminal ones, (5)7–16 mm long, 6–14 mm wide, the terminal leaves always 2 in number, reduced, suborbicular-reniform, approximately $1\frac{1}{2}$ times wider than long, obtuse; cyathium campanulate, 1–1.5 mm long and broad, glabrous or ciliate outside, sparingly pubescent inside, with ovate fimbriate lobes; nectaries 4, dull yellow, later brown-yellow, transversely elliptic; styles 0.5–1 mm long, connate below, thickly 2-lobed; schizocarp flattened-globulose, 1.8–2 mm long, 2–2.5 mm wide, more or less trisulcate, glabrous, with numerous short conical processes on dorsal surface of cocci; seeds compressed-ovate, ca. 1.5 mm long, 1–1.2 mm wide, smooth, brown, with small crescent-shaped sessile appendage. June–July.

Exposed places in valleys and ravines, rarely among shrubs, in plowed fields, roadsides, ditches, up to foothills, preferably on rich soil. — European part: U. Dns., M. Dnp., Bes., Bl., Crim.; Caucasus: Cisc., Dag., W., E. and S. Transc., Tal.; Centr. Asia; Ar.-Casp. (eastern shore of Caspian). Gen. distr.: Centr. and Atl. Eur., Med., Bal.-As. Min., introduced into N. Am. Described from Europe. Type in London.

35. *E. platyphylla* L. Sp. pl. (1753) 460; M. B. Fl. taur.-cauc. I, 377, III, 327; Ldb. Fl. Ross. III, 562; Boiss. in DC. Prodr. IV, 2, 133; Fl. or. IV, 1099; Hegi, Ill. Fl. V, 1, 160. — *Tithymalus platyphyllos* (L.) Rafin. Fl. tellur. IV (1838) 115, nomen altern. — Ic.: Jacq. Fl. austr. IV, tab. 376; Engl. Bot. tab. 333; Rchb. Ic. Fl. Germ. V, tab. 133, f. 4758; Hegi, Ill. Fl. V, 1, f. 1769. — Exs.: G. R. F. No. 2579.

Annual plants, (10)20–60 cm high, with a mouselike odor; root fusiform; stems generally many, erect or ascending from a shortly-curved base, 368 5–6 mm thick, glabrous or hairy above, simple below, only sometimes with 2 opposite sterile branches, bearing above 1–7 axillary peduncles 1–2.8 cm long, very rarely with short sterile branches under them; cauline leaves spreading or recurved, sessile or often short-petiolate, narrowly truncate or slightly cordate at base, the lower obovate, obtuse, the upper oblanceolate, (1.5)2–5.5 cm long, 5–16 mm wide, all leaves serrate from the middle, thick, yellowish-glaucous or grayish green, glabrous or sparingly hairy. Terminal peduncles 3–5, 1.8–11 cm long, like axillary peduncles 3-branched then once or twice or even more times forked; leaves of involucre ovate or lanceolate, 1.2–3.3 cm long, 0.5–1.5 cm wide, acute, finely serrate; leaves of involucels broadly truncate or slightly cordate at base, broadly triangular-orbicular or triangular-ovate, acuminate or cuspidate, the lower 3, (6)7–13(30) mm long, (6)8–16 mm wide, the terminal 2, reduced, as wide as long or even wider; cyathium campanulate, 1–1.5 mm long, 1.5–2 mm in diameter, pubescent or glabrous outside, pubescent inside, with ovate

oblong fimbriate lobes; nectaries 4, broadly ovate, yellow or greenish-yellow; styles 1.5–2 mm long, connate for $\frac{1}{3}$, thickly 2-lobed; schizocarp flattened-globulose, 2.5–3 mm long, 3–3.5 mm wide, obscurely trisulcate, cocci with glabrous nerve at the middle of their dorsal surface and scattered subglobular processes at sides; seeds compressed-orbicular-ovate, 1.7–2 mm long, 1.5–1.8 mm wide, smooth, brown-green, with small reniform appendage. June–September.

Exposed places, sparse shrubs, in plowed fields, roadsides and ditches, preferably on rich soil, lowlands up to foothills. — European part: M. Dnp., Crim.; Caucasus: W. Transc. **Gen. distr.:** Centr. and Atl. Eur., Med., Bal.-As. Min., introduced into N. Am. Described from Western Europe ("from the fields of France and Germany"). Type in London.

36. *E. microsphaera* Boiss. Diagn. ser. I, VII (1846) 87; in DC. Prodr. XV, 2, 118; Fl. or. IV, 1098. — ? *E. subtuberculata* C. A. M. ex Boiss. in DC. Prodr. XV, 2, 118; Fl. or. IV, 1098. — *Tithymalus microsphaerus* (Boiss.) Kl. et Gke. ex Klotzch in Abh. Akad. Berl. 1859 (1860) 74, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 117. — Ic.: Prokh. l. c. tabl. 34. — Exs.: H. F. A. M. No. 305 ("*E. subtuberculata*").

369 Perennial plants, 30–35(70) cm high, mostly glabrous, glaucous; stems erect, 3–8 mm thick below, branching from base, bearing above 1–7 axillary peduncles 2–7 cm long, in lower part with leaf scars; cauline leaves subsessile, narrow and more or less rounded at base, the lower leaves obovate, obtuse, the others oblong-lanceolate, (1.5)2.5–4.5 cm long, (5)8–17 mm wide, serrate, glabrous. Terminal peduncles 5, 1.5–7 cm long, like axillary peduncles 3-branched then once or twice bifurcate; leaves of involucre elliptic, 1.5–2.5(3) cm long, 8–11 mm wide; leaves of involucels more or less rounded at base, ovate-orbicular, obtuse or short-cuspidate, serrate, the lower 3, 9–18 mm long, 7–10 mm wide; the terminal 2, reduced; cyathium campanulate, 2–2.5 mm long, 1.5–2 mm in diameter, hairy, with ovate obtuse ciliate lobes; nectaries 4, transversely elliptic; styles 1–1.5 mm long, half-connate; schizocarp flattened-globulose, 2.5–3 mm long, 3–3.5 mm wide, faintly sulcate, nearly smooth, indehiscent, at first more or less ciliate, later glabrescent, brown; seeds compressed-ovate, 2–2.5 mm long, smooth, with small oblique obtuse conical sessile appendage. June.

Roadsides. — Caucasus: Tal. (Nowdi); Centr. Asia: Syr D. (only in Tashkent). **Gen. distr.:** E. Med., Bal.-As. Min. (E.), Iran (N.). Described from the foot of Sabstbushom near Shiraz in Iran. Type in Geneva.

Note. There is only one locality in Central Asia, near Tashkent; apparently it has been introduced there.

37. *E. coniosperma* Boiss. et Buhse in Nouv. Mém. Soc. Nat. Mosc. XIII (1860) 196; Boiss. in DC. Prodr. XV, 2, 134; Fl. or. IV, 1100; Lipskii in Tr. B. S. XIII, 331. — *Tithymalus coniospermus* (Boiss. et Buhse) Prokh. comb. nova, nomen altern.

Annual glabrous plants, 10–14 cm high; stems branching from base, flexuous, only 3–6 cm long, with 1–11 axillary peduncles 1.2–2.7 cm long; cauline leaves more or less petiolate, long-cuneate at base, oblong-obovate,

(1.2) 1.5–2.5 cm long, 4–6 mm wide, entire, obtuse, with 3 obscure veins at base, pale. Terminal peduncles 3, 1.5–3 cm long, like axillary peduncles forked many times; leaves of involucre oblong-obovate, 1.8–2.5 cm long, (5) 8–10 mm wide; leaves of involucels sessile, ovate, 1–2 cm long, 5–8 mm wide, acute, obscurely incised at margin, 3–5-veined from base; cyathium turbinate, ca. 1 mm long and broad, glabrous, with triangular-ovate lacerated lobes; nectaries 4, yellowish, transversely oblong; styles 0.5–1 mm long, connate at base, bifid; schizocarp turnip-shaped, 2–3 mm long, 2.5–3.5 mm wide, deeply trisulcate, cocci with acute compressed-conical approximate processes arranged in 2 rows on upper part of their dorsal surface; seeds ovate, 1.5–1.8 mm long, 1.2–1.5 mm wide (under magnifying glass), with fine farinaceous bloom, ash-gray, rarely golden yellow or yellowish with black spots, without appendage. Fl. May, Fr. June. (Plate XX, Figure 3.)

Clayey slopes. — Caucasus: S. Transc. Gen. distr.: Iran. (N.) Described from the vicinity of Gamarlu, in the Aras River valley near Erivan. Type in Geneva.

38–40. These species are intermediate between the subsections Lutescentes and Purpuratae, combining the characters of styles and colors of both groups.

38. *E. alpina* C. A. M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 26; Fl. alt. IV, 186; Fl. Ross. III, 561; Boiss. in DC. Prodr. XV, 2, 122; Prokh. in Izv. Akad. Nauk SSSR (1927) 206; Kryl., Fl. Zap. Sib. VIII, 1865. — *Tithymalus alpinus* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akag. Berl. 1859 (1860) 70, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 86. — Ic.: Gmel. Fl. Sib. II (1749) tab. 95, f. 1; Ldb. Ic. pl. Fl. Ross. tab. 188; Prokh., Obz. moloch. Sr. Azii. tabl. 21. — Exs.: G. R. F. No. 1239.

Perennial plants, 10–35(50) cm high, more or less pubescent or rarely glabrous; root 0.5–1.5 cm thick, multicapital, vertical or obliquely descending; stems erect or slightly spreading, spreading-hairy, branching, with axillary peduncles on usually sterile branches; cauline leaves subsessile or short-petiolate, cordate at base, oblong-elliptic or ovate-lanceolate, 1–2.5(3.5) cm long, 5–15(20) mm wide, obtuse or truncate, sometimes even slightly emarginate, entire, finely serrate above, 1-nerved. Inflorescence corymbiform-paniculate; terminal peduncles 2–3, short, inconspicuous; axillary peduncles many, like the terminal, simple or bifurcate; leaves of involucels 2, orbicular-ovate, 0.7–2 cm long, 6–15 cm wide, obtuse, finely crenate or rarely entire, yellowish at anthesis; cyathium broadly campanulate, ca. 3 mm in diameter, glabrous outside, slightly hairy inside, lobes rather large, orbicular, obtuse, ciliate; nectaries transversely oblong, yellowish or reddish; styles thin, 0.8–1 mm long, connate for $\frac{1}{3}$ to $\frac{1}{2}$, bifid; schizocarp flattened-globulose, 4–5 mm long, somewhat trisulcate, with conical (up to 1 mm long) usually reddish processes; seeds ovate, 2–3 mm long, brown, with obtuse conical appendage. May – first half of June.

Stony and herbaceous slopes and rocky places in the alpine and mountain-steppe zone, especially along river systems. — W. Siberia: Alt.; E. Siberia: Ang.-Say. Gen. distr.: Mong. (NW. Mongolia, only at the source of Bzau-Kul River). Described from Krestovaya Mountain near Ridder in Altai. Type in Leningrad.

39. *E. macrorrhiza* C.A.M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 26; Fl. alt. IV (1838) 191; Fl. Ross. III, 566; Boiss. in Dc. Prodr. XV, 2, 123; Kryl., Fl. Zap. Sib. VIII, 1870. — *Tithymalus macrorrhizus* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 79, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 90. — Ic.: Ldb. Ic. pl. Fl. Ross. tab. 192; Prokh., l. c. tabl. 23.

Perennial plants, 20–40 cm high, pale green; root thickened (1–2.5 cm thick), slightly fleshy, vertical or obliquely descending, multicapitate; stems usually fairly numerous, erect, up to 35 cm high, tomentose (especially above) with short crisp appressed hairs, branching and bearing numerous axillary peduncles but without sterile branches; basal leaves small, ovate, brown, scarious; cauline leaves sessile, tapering at base, oblong-elliptic or lanceolate, 2–4 cm long, 5–14 mm wide, obtuse or acute, entire or denticulate at apex, with prominent vein, glabrous but the lower ciliate at margin. Inflorescence short-paniculate; terminal peduncles 3–5, short, inconspicuous; axillary peduncles, like the terminal, simple or sometimes with 1–2 secondary peduncles at summit; leaves of involucre similar to upper cauline but slightly smaller and yellowish at anthesis; leaves of involucels in whorls of 3 or 4 (sometimes 2, only on uncommon secondary peduncles), obovate or elliptic, longer than wide, obtuse or short-cuspidate, yellowish; cyathium rotate, 3–4 mm long, ca. 5 mm in diameter, glabrous outside, slightly lanate inside, with orbicular-ovate glabrous lobes (1–1.5 mm in diameter); nectaries yellow, transversely elliptic; styles 0.5–1 mm long, nearly free, thickly 2-lobed; schizocarp subglobulose, 4.5–5.5 mm long, 4–5 mm wide, nearly not sulcate, with many cylindrical-subfiliform processes (1–2 mm); seeds compressed-ovate, 3–4 mm long, with transversely oblong short-stalked appendage. April–May.

Barren stony slopes of hills, rarely steppes. — W. Siberia: Irt. (SE), Alt.; Centr. Asia: Balkh. (NE: Lake Zaisan). Endemic? Described from the vicinity of Ridder and Ust-Kamenogorsk. Type in Leningrad.

40. *E. buchtormensis* C.A.M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 26; Fl. alt. IV, 189; Fl. Ross. III, 565; Boiss. in DC. Prodr. XV, 2, 123; Kryl., Fl. Zap. Sib. VIII, 1869. — *E. subamplexicaulis* Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 744; Ldb. Fl. Ross. III, 562; Prokh. 372 in Izv. Akad. Nauk SSSR (1927) 207. — *Tithymalus buchtormensis* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 79, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 94. — Ic.: Ldb. Ic. pl. Fl. Ross. tab. 189; Prokh., Obz. moloch. tabl. 25.

Glabrous perennial plants; root thick, descending, multicapital; stems many, erect, 20–30 cm high, hispid at base, otherwise glabrous, generally simple, only above sometimes with few axillary peduncles; basal leaves squamiform, ciliate; cauline leaves very short-petiolate, cordate and sometimes amplexicaul at base, oblong-elliptic or spatulate-obovate, 1.5–2.5 cm long, 5–10 mm wide, commonly wider towards apex, obtuse, glabrous, pale green, glaucescent beneath, sometimes also somewhat reddish, finely serrate or subentire, sometimes slightly hairy at margin. Terminal peduncles 5 (rarely 4), like axillary peduncles with 2–4 secondary peduncles at summit, then usually bifurcate; leaves of involucre resembling cauline leaves but sometimes slightly smaller in shape and size; leaves of involucels small,

rounded and slightly cordate at base, elliptic, obtuse, finely serrate, yellow at anthesis, the lower mostly 3, unequal, the upper 2 in number; cyathium broadly campanulate, 3–4 mm in diameter, glabrous outside, lanate inside, lobes small, oblong, obtuse, ciliate; nectaries dark, transversely elliptic; styles 0.5–1 mm long, connate at base, 2-lobed; schizocarp flattened-globulose, hardly trisulcate, cocci with yellowish subulate grooved processes. Second half of April (early spring).

Rocky places. — W. Siberia: Alt. (Naryn Range in the west); Centr. Asia: Dzu.-Tarb. (Tarbagatai Range). Gen. distr.: Dzu.-Kash. (E. Tien Shan, source of Tsangma River?). Described from Naryn Range near Bukhtarminsk. Type in Leningrad.

Subsection 2. PURPURATAE Prokh. subsect. nova in Addenda XIII, 737. — Styles nearly free, sometimes slightly connate at base, more or less deeply bifid at apex, not thickened; leaves of involuclers and sometimes of involucre more or less reddish-purple. Type of subsection: *Euphorbia dulcis* L.

41. *E. pubescens* Vahl, Symb. bot. II (1791) 55; Boiss. in DC. Prodr. XV, 2, 134; Fl. or. IV, 1106. — *Tithymalus pubescens* (Vahl) Prokh. comb. nova, nomen altern. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 138, f. 4769.

373 Perennial (or annual) villous plants, 25–80 cm high, strongly branching at base hence many-stemmed; stems erect, 4–5 mm thick, densely leafy, branching, sometimes only with short sterile branches, often with 2–8 axillary peduncles above (0.4–1.7 cm, sometimes up to 8 cm long); cauline leaves sessile or short-petiolate, somewhat cordate at base, oblong-obovate or oblong-linear, 1.4–4(6) cm long, 7–11(19) mm wide, dilated above, acute or acuminate, sometimes obtuse, serrate, pinnately veined. Terminal peduncles 5, 0.5–4.5 cm, sometimes up to 12 cm long, like axillary peduncles 3-branched and then 1–3 times forked; leaves of involucre oblong-elliptic or ovate-oblong, 1–2(4.5) cm long, 6–11(18) mm wide; leaves of involuclers villous, the lower commonly 3, 6–13(25) mm long, 7–12(20) cm wide, others two in number, the terminal reduced; cyathium campanulate, 1.5–2 mm long and broad, villous outside, with ovate truncate ciliate lobes; nectaries 4, transversely oblong, short-ciliate outside and along margin; styles 1–1.5 mm long, nearly free, bifid; schizocarp globulose, 2.5–3 mm long, 3.5–4 mm wide, trisulcate, cocci with a nerve at middle and dense short-cylindrical processes at sides, more or less villous; seeds compressed-ovate, 2–2.5 mm long, somewhat rough because of short, sometimes inconspicuous tubercles, with small saucer-shaped appendages. May.

Damp places. — Caucasus: W. Transc. (the shoreline from Poti to the frontier). Gen. distr.: W. and E. Med. Described from Tunis. Type in Copenhagen?

42. *E. alata* Boiss. Cent. Euph. (1860) 33; in DC. Prodr. XV, 2, 123; Prokh. in Izv. Akad. Nauk SSSR (1927) 206. — *E. kaschgarica* Rgl. in Tr. B. S. VI (1879) 401. — *E. buchtormensis* var. *alata* Rgl. l. c. 400. — *Tithymalus alata* (Boiss.) Prokh., Obz. moloch. Sr. Azii (1938) 97, nomen altern. — Ic.: Prokh., Obz. moloch. tabl. 26.

Perennial plants, 8–40 cm high, glaucous-gray, often reddish, usually more or less pubescent; root thick; stems many, more or less erect, pubescent or rarely subglabrous, usually with few short axillary peduncles above, below sometimes with sterile branches; cauline leaves rounded or cordate, rarely slightly attenuate at base, ovate-elliptic or sometimes nearly ovate or lanceolate-elliptic, 1–2.5(3.5) cm long, 0.4–3 cm wide, more or less villous especially beneath, sometimes subglabrous, crenate-serrate, 1-veined, lower leaves obtuse, the upper more or less acute. Terminal peduncles 5–8, rather short, 0.6–3.5 cm long, like axillary peduncles simple or rarely 3-branched; leaves of involucre shorter than cauline leaves, rhombic-obovate or ovate-orbicular; leaves of involucels
374 always 3 in number, subequal, orbicular-ovate; cyathium campanulate, 3–4 mm in diameter, completely glabrous, lobes ovate-orbicular, glabrous, often reddish, crenate; nectaries transversely elliptic, slightly concave; styles 1–1.5 mm long, free, bifid; schizocarp flattened-globulose, 2.5–3.5 mm long, 3.5–4.5 mm wide, deeply sulcate, cocci orbicular, dorsally with short, thickened, obtuse, conical processes; seeds ovate-globular, 1.5–2 mm long, smooth, dark brown, with rather large obtuse conical appendage. Fl. June–July, Fr. July–August. (Plate XX, Figure 1.)

Edges of mountain forests, usually of spruce, in the subalpine belt, forest plots and damp meadows. — Centr. Asia: Dzu.-Tarb. (Dzungarian Ala-Tau), T. Sh., Pam.-Al. (Alai Range near Gulcha). Gen. distr.: Dzh. -Kash. (E. Tien Shan). Described from meadows in Dzungarian Ala-Tau. Type in Leningrad.

43. *E. lucorum* Rupr. ex Maxim. Prim. Fl. Amur. (1859) 239; Boiss. in DC. Prodr. XV, 2, 120; Kom., Fl. Man'chzh. II, 687. — *Tithymalus lucorum* (Rupr.) Prokh. comb. nova, nomen altern.

Perennial plants, (20)30–75 cm high, commonly more or less violet; root separating below into thick cylindrical parts; stems solitary, rounded (2–6 mm thick), densely hirsute, with spreading white hairs, bearing above 2–8 axillary peduncles, 2–8(12.5) cm long, without sterile branches; basal leaves 7–15 mm long, ca. 5 mm wide, long persistent; cauline leaves sessile, not tapering at base or only slightly so, oblong or oblong-elliptic, 1.5–6(7.3) cm long, 6–17(22) mm wide, usually with nearly parallel margins but upper leaves dilated below middle, obtuse or acute, recurved at margin, obscurely serrate, ciliate more densely so beneath, rarely glabrous. Terminal peduncles 5–8 (often 5), reclining, pubescent or glabrous, 2.5–9(12) mm long, like axillary peduncles 3-branched and then sometimes bifurcate; leaves of involucre ovate-rhombic or elliptic, 1.3–4.3 cm long, 8–12(27) mm wide, widest usually below middle, distinctly dentate-serrate, glabrous; leaves of involucels truncate or short-cuneate at base, triangular-rhombic or sometimes suborbicular, obtuse, serrate, glabrous, the lower 3 in number (8)9–27 mm long, (7)9–23 mm wide, the terminal 2, reduced; cyathium turbinate, 2–3 mm in diameter, glabrous outside, slightly hairy inside, with short-ovate lobes; nectaries 4, transversely elliptic; styles 1.5–2(2.5) mm long, free, deeply bifid; schizocarp subglobulose, ca. 3 mm long, 3–4 mm wide,
377 trisulcate, with flattened-triangular processes dilated at base and fused into a crest; seeds ovate, becoming black, with subglobular, truncate appendage. Fl. May – first half of June, sometimes August, Fr. second half of June.



PLATE XIX. 1—*Euphorbia semivillosa* Prokh.; 2—*E. eugeniae* Prokh. 3—*E. transoxana* Prokh.; 4—*E. tauricola* Prokh.; 5—*E. palustris* L.

Mountain forests.— Far East: Uss. Gen. distr.: Manchuria.
Described from near Kinneli on the Amur River. Type in Leningrad.

44. *E. condylocarpa* M. B. Fl. taur.-cauc. I (1808) 377, et III, 328; Ldb. Fl. Ross. III, 567; Boiss. in DC. Prodr. XV, 2, 126; Fl. or. IV, 1102.— *E. amplexicaulis* Ldb. Fl. Ross. III (1849–1851) 567.— *Tithymalus condylocarpus* (M. B.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 78, nomen altern.— Ic.: Boiss. Ic. Euph. tab. 77.

Perennial plants, 10–45(54) cm high, glabrous, with subglobose tuber 1–4 cm wide; stems usually solitary, rarely 2–3, 2–8 mm thick, thinner at base, densely leafy, with internodes 3–6 (rarely 10) mm long, bearing above 6–40 axillary peduncles 1–4.5 cm long, without sterile branches; basal leaves scarious, deciduous, the basalmost squamiform; cauline leaves sessile, dilated-cordate and amplexicaul at base, lanceolate or oblong, 1.3–3.5(5) cm long, (4)5–16(18) mm wide, obtuse or acute, serrate, the upper reduced. Inflorescence paniculate; terminal peduncles (3)5, 1–3 cm long, often inconspicuous; axillary peduncles many, like the terminal, bifurcate; leaves of involucre triangular-lanceolate or oblong-triangular or rhombic-ovate, 8–18 mm long, (3)5–10 mm wide, serrate; leaves of involucels 2, narrowed at base, rhombic-reniform, wider than long (the lower 4–7(13) mm long, 8–10(16) mm wide), usually more or less serrate, obtuse, sometimes abruptly cuspidate, often more or less reddish; cyathium subglobose-turbinate, ca. 1.5 mm long, 2 mm in diameter, glabrous, with short broad transversely oblong lobes; nectaries 5, transversely elliptic; styles 0.5–1 mm long, nearly free, cleft; schizocarp short-stalked, subglobose, 4–4.5 mm long, 3.5–5 mm wide, faintly trisulcate, with subglobose conical processes; seeds compressed-ovate, ca. 2.5 mm long, brown, smooth, with appendage. April—first half of May.

Forests and shrubby formations, stony and rocky slopes.— Caucasus: Cisc., W., E. and S. Transc. Gen. distr.: Iran. Described from mineral source Narzan (Kislovodsk) in the foothills of the Caucasus. Type in Leningrad.

45. *E. wittmanni* Boiss. Cent. Euph. (1860) 31, et in DC. Prodr. XV, 2, 115; Fl. or IV, 1095.— *Tithymalus Wittmanni* (Boiss.) Prokh., comb. nova, nomen altern.

378 Perennial, glabrous plants, 10–32 cm high; root thick, vertical, often branching above; stems many, somewhat woody at base, decumbent or ascending, low, densely leafy, short-branching with sterile branches, sometimes bearing only above 1 or 2 axillary peduncles 2–2.5 cm long; cauline leaves scarious, pale green, sessile, narrowly cartilaginous and reddish at margin, serrate-eroded, upper leaves oblong or rhombic-elliptic, 1.4–3.7 cm long, 0.4–1 cm wide, the lower, like all leaves on sterile branches, narrowly oblanceolate or oblong-lanceolate, (0.8)1–2.5 cm, long, (1.5)2–4 mm wide, acute. Terminal peduncles 5, thin, 0.3–3.7(5) cm long, like the axillary peduncles forked at summit; leaves of involucre shorter than cauline leaves, 9–20 mm long, (4)6–10(11) mm wide; leaves of involucels 2, orbicular-ovate or obovate, (5)7–14 mm long, (3)5–10 mm wide, obtuse, entire, usually reddish; cyathium turbinate-campanulate, ca. 2 mm long, 2–3 mm in diameter, glabrous, rimmed below, with broadly ovate

ciliate lobes; nectaries 5, transversely oblong; stigmas sessile (without styles), forming 6-lobed disk; ovary glabrous, ovate; schizocarp globose-ovoid, 3.5–4 mm long, ca. 4 mm wide, smooth; seeds compressed-ovate, 2–2.5 mm long, brown, smooth, with disciform appendage. April–May. (Plate XX, Figure 2.)

Stony slopes and rocky places. — Caucasus: S. Transc. (W.). Endemic. Described from Atskuri and Uzurgeti (Georgia). Type in Leningrad.

46. *E. pachyrrhiza* Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 744; Ldb. Fl. Ross. III, 562; Boiss. in DC. Prodr. XV, 2, 123; Prokh. in Izv. Akad. Nauk SSSR (1927) 207; Kryl., Fl. Zap. Sib. VIII, 1866. — *Tithymalus pachyrrhizus* (Kar. et Kir.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 69, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 82. — Ic.: Prokh., Obz. moloch. tabl. 19.

Perennial green glabrous plants, 10–30(50) cm high; root thick; stems many, tufted with last year's relics, woody at base, more or less erect, thin, virgate, usually branching, bearing above axillary peduncles and below sterile branches; cauline leaves alternate, sessile or short-petiolate, cuneate at base, oblong-obovate or elliptic, 1–2.2 cm long, 4–11 mm wide, obtuse, finely serrate, scarious, 1-nerved. Terminal peduncles 3–5, 1–2 cm long, like axillary peduncles simple or forked at summit; leaves of involucre similar to the cauline; leaves of involucels always 2, a little smaller in size and shape, generally orbicular-elliptic; cyathium broadly infundibular, 3–4 mm in diameter, glabrous outside, densely tomentose inside (under nectaries), with ovate dentate lobes; nectaries transversely
379 elliptic; styles 0.5–1 mm long, free, divergent, bifid; schizocarp globose-oblong, 3.5–4.5 mm long, 3–4 mm wide, hardly furrowed, with reddish, compressed-conical processes; seeds compressed-ovate, ca. 3 mm long, smooth, gray-brown, with rather large transversely oblong appendage. Fl. May–June, Fr. second half of June – first half of August.

Dry stony slopes. — Centr. Asia: Dzu.-Tarb., T. Sh. Gen. distr.: Dzu.-Kash. (Kuldja district). Described from Akchavly Mountains, Tarbagatai Range. Type in Leningrad.

47. *E. talastavica* Prokh., Obz. moloch. Sr. Azii (1933) 95. — *E. Abolini* Eug. Kor. in herb. nomen. — *Tithymalus talastavicus* Prokh. l. c. nomen altern.

Glabrous perennial plants, 25–50 cm high; root thick, stems many, tufted with last year's relics, erect, simple; cauline leaves subsessile, rounded or often slightly cordate at base, oblong-ovate or linear-oblong, 1.5–3.8 cm long, 8–13 mm wide, obtuse, acutely serrate, leaves on sterile branches and the upper narrower, linear-lanceolate. Terminal peduncles 5(7), thin, 1.5–3 cm long, simple or forked at summit; leaves of involucre generally longer than peduncles, rounded at base, oblong-ovate or elliptic, 1.9–3.3 cm long, 8–16 mm wide, obtuse, serrate; leaves of involucels 2, rounded at base, ovate-lanceolate or elliptic, 0.8–2.2 cm long, 3–14 mm wide, widest at the middle, obtuse or acute, serrate; cyathium broadly campanulate, 3–4 mm in diameter, pubescent inside, with orbicular glabrous yellowish crenate lobes; nectaries 4(5), small, transversely elliptic, brown; styles 1–1.5 mm long, connate at base, 2-lobed; schizocarp flattened-globose, 4–5 mm long, ca. 5 mm wide, slightly trisulcate, cocci sparsely

beset with rather short subglobular processes; seeds globular, ca. 2.5 mm long, smooth, brown, with small disciform sessile appendage. (Plate XX, Figure 4.)

Mountain slopes, sometimes rock debris. — Centr. Asia: T. Sh. (Talass Ala-Tau and Kara-Tau Ranges in the west). Endemic. Described from Talass Ala-Tau, from the Aksai River gorge. Type in Tashkent.

48. *E. dulcis** L. Sp. pl. (1753) 457, em Jacq. Fl. austr. III (1775) 8; Ldb. Fl. Ross. III, 566; Boiss. in DC. Prodr. XV, 2, 127; Fl. or. IV, 1103; Hegi, Ill. Fl. V, 1, 154. — *E. purpurata* Thuill. Fl. Par. (1790) 235. — *E. solisequa* Rchb. Fl. exsc. (1832) 756. — *E. incompta* Cesati in Bibl. Ital. XCL (1838) 348. — *Tithymalus dulcis* (L.) Scop. Fl. carn. ed. 2, I (1772) 334, nomen altern. — Ic.: Jacq. l. c. tab. 213; Rchb. Pl. crit. II (1824) tab. 143; Ic. Fl. Germ. V, tab. 134, f. 4759; Hegi, Ill. Fl. V, 1, tab. 178, f. 1 et f. 1765. — Exs.: Fl. exs. austro-hung. No. 495.

380

Perennial plants, 20–55 cm high, glabrous or sparingly pubescent; rhizome simple or branching, horizontal, fleshy, jointed with short-cylindrical thickened nodes obliquely connected; stems 1–2, arcuately ascending from rhizome then erect, 2–4 mm thick, sometimes finely striate, sparingly hairy, commonly with 3–9 axillary peduncles (3–7 cm long), without sterile branches, internodes conspicuous, sometimes with approximate-verticillate leaves above; basal leaves squamiform; cauline leaves few, short-petiolate, more or less rounded at base, oblong or elliptic or oblong-obovate, (2.3)3.5–7.5 cm long, 9–20 mm wide, more or less obtuse, finely serrate or subentire (in terminal leaves), glabrous above, paler beneath, sparingly soft-hairy or subglabrous. Terminal peduncles 5–6, thin (2.5–7.5 cm long), like axillary peduncles simple or rarely forked at summit; leaves of involucre oblong-elliptic or broadly lanceolate, half as long as to generally longer than peduncles, 2–6.3 cm long, 7–19 mm wide, denticulate above, sparsely ciliate, green; leaves of involucels 2, truncate or slightly cordate at base, triangular-ovate or oblong-triangular, 1.2–2.5 cm long, 8–17 mm wide, generally more or less (up to twice) longer than wide, green; cyathium short-turbinate, ca. 2 mm long, 3 mm in diameter, completely glabrous, with small ovate glabrous dentate lobes; nectaries 4, transversely elliptic, yellowish-green, later dark purple; styles 1–1.5 mm long, connate below, bifid; schizocarp flattened-globulose, ca. 3 mm long, 3.5 mm wide, trisulcate, sparingly beset with unequal short-cylindrical processes, spreading-hairy (var. *lasiocarpa* Neilreich) or rarely glabrous (var. *incompta* Cesati); seeds compressed-ovate-globular, ca. 2 mm long, smooth, pale brown, with flattened reniform stalked appendage. May–June.

Shady edges of mountainous forests (especially beech), shrubby formations, grass plots, near streams, rarely in lowlands, commonly in mountains up to the subalpine zone (up to 1,500 m), usually in calcareous soil. — European part: U. Dns., M. Dnp., Bes. **Gen. distr.:** Centr. and Atl. Eur., W. Med. (N.), Bal. (NE). Described from W. Europe ("France, Italy, Germany"). Type in London.

* Named so because it contains less acrid latex than the other species.

Note. This species was accepted by Boissier in Jacquin's strict sense, on the basis of only one of three specimens in the Linnaeus herbarium (the other two refer to *E. verrucosa* L. em. Jacq.).

Of interest is the dispersal of seeds: first by autochory (bursting of cocci) and then myrmecochory. Also of considerable interest is the typical rhizome.

- 381 49-51. Species related to subsection *Purpuratae*, although intermediate to subsection *Lutescentes* according to the yellow color of the terminal leaves.

49. *E. angulata* Jacq. *Collectanea*, II (1788) 309; Ldb. *Fl. Ross.* III, 566; Boiss. in DC. *Prodr.* XV, 2, 127; Hegi, *Ill. Fl.* V, 1, 156. — *Tithymalus angalatus* (Jacq.) Rafin. *Fl. tellur.* IV (1838) 115, nomen altern.; Kl. et Gke. ex Klotzsch in *Abh. Akad. Berl.* 1859 (1860) 77. — Ic.: Jacq. *Ic. pl. rar.* III tab. 481; Rchb. *Pl. crit.* II, tab. 144; Fj. *Ic. Fl. Germ.* V, tab. 135, f. 4762; Hegi, *Ill. Fl.* V, 1, f. 1766. — Exs.: G.R.F. No. 2582; *Fl. Stir. exs.* No. 639, 640.

Perennial plants, 15-43 cm high; rhizome simple, rarely branching, thin, horizontally creeping, jointed, internodes alternately long and winding, small and tuberiform-ovate; stems arising from the ovate tubers ascending or erect, thin, (1.5-2 mm), acutely ribbed, glabrous, simple, internodes 1.5-5.5 cm long, the upper up to 8 cm; basal leaves squamiform; cauline leaves 4-7, sessile, slightly tapering or rounded at base, oblong or elliptic, 1.7-3.6 cm long, 5-16 mm wide, more or less obtuse at apex, finely serrate, scarious, glabrous or hairy, especially beneath. Terminal peduncles (3)5, 1.5-2.5 cm long, simple or forked at summit; leaves of involucre rhombic-ovate or elliptic, always much shorter than peduncles, 8-25 mm long, 6-18 mm wide, acute; leaves of involucels always 2, truncate or slightly cordate at base, triangular-ovate or triangular-orbicular, 7-14 mm long, 8-16 mm wide, obtuse, serrate, flat, yellowish; cyathium short-turbinate, 2-2.5 mm long, 3-3.5 mm in diameter, glabrous outside, hairy inside, with conspicuous ovate-orbicular fimbriate lobes; nectaries 4, transversely elliptic, greenish, later yellowish-red; styles 0.5-1 mm long, connate at base, 2-lobed; schizocarp flattened-globulose, 2.5-3 mm long, ca. 2.5 mm wide, sparsely beset with subglobular or conical processes; seeds ovate, smooth, with short conical sessile appendage. May-June.

Shrubby formations, edges of shady forests, slopes and gorges, plains up to foothills. — European part: U.Dns., M.Dnp., Bes., Bl. (only near Odessa). — Gen. distr.: Centr. Eur. (E.), Atl. Eur. (S.). Described from Austria. Type in Vienna.

Note. Of interest is its interrupted distribution area in Europe, being absent in Germany and Switzerland.

50. *E. altaica* C.A.M. ex Ldb. *Ic. pl. Fl. Ross.* II (1830) 26; *Fl. alt.* IV, 190; *Fl. Ross.* III, 565; Boiss. in DC. *Prodr.* XV, 2, 128; Kryl., *Fl. Zap. Sibiri*, VIII, 1869. — *Tithymalus altaicus* (Ldb.) Kl. et Gke. ex Klotzsch in *Abh. Akad. Berl.* 1859 (1860) 73, nomen altern. — Ic.: Ldb. *Ic. pl. Fl. Ross.* tab. 191.

- 382 Perennial glabrous plants, 12-40 cm high; rhizome horizontally creeping, angular-cordlike, dark, branching, multicapitate; stems fertile and

sterile, simple (only very rarely with 1 lateral peduncle), with internodes 1–3 cm, the upper up to 11.2 cm long, sometimes with approximate-verticillate leaves above; basal leaves squamiform, reddish; cauline leaves few (5–11), sessile, rounded at apex, scarious, finely serrate, the lower elliptic, slightly tapering at base, the upper gradually becoming larger, obovate, 1.5–4.5 cm long, 5–18 mm wide, leaves on sterile shoots narrowly oblanceolate, 3–3.5 cm long, 7–9 mm wide. Terminal peduncles (4)5, 1–3.5 cm long, almost always simple, rarely forked at summit; leaves of involucre slightly tapering at base, ovate-rhombic, 1.5–3.8 cm long, 1–2 cm wide, rounded, yellowish; leaves of involucels 2, ovate-triangular, 8–15 mm long, 5–14 mm wide, as long as wide or slightly longer, short-cuspidate, yellowish; cyathium turbinate-subglobose, 2–2.5 mm long, 4–5 mm in diameter, completely glabrous, with orbicular (up to 1 mm wide) dentate glabrous lobes; nectaries 4, transversely elliptic, glabrous; styles ca. 1 mm long, nearly free, 2-lobed; schizocarp flattened-globulose, 3–4 mm long, 4–5 mm wide, trisulcate, glabrous, with short (up to 0.5 mm) thick, scalelike processes; seeds orbicular-elliptic, ca. 2.5 mm long, smooth, with appendage. May – first half of June.

Subalpine meadows and lower mountain slopes, wooded and sometimes open. – W. Siberia: Alt.; E. Siberia: Ang.-Say. (S.). Endemic. Described from Altai, Charysh River valley. Type in Leningrad.

51. *E. eriophora* Boiss. Diagn. ser. 1, V (1844) 51 et in DC. Prodr. XV, 2, 118; Fl. or. IV, 1097. – *E. lasiocarpa* C. Koch in Linnaea, XXI (1848) 721, non Klotzsch (1843). – *Tithymalus eriophorus* (Boiss.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 65, nomen altern. – Ic.: Boiss. Ic. Euph. tab. 66.

Annual plants, 15–25 cm high, softly hirsute, gray; stems erect, 4–9 cm high, 3–5 mm thick, rounded, simple or often with 1–3, 4.5–10 cm long, axillary peduncles above, without sterile branches; cauline leaves subsessile, cuneate at base, oblanceolate, 2.5–4 cm long, 6–8 mm wide, gradually becoming larger upwards, acute, denticulate. Terminal peduncles 3(4), generally spreading and curved, 2–5.5 cm long, like axillary peduncles furcate for 3–7 times; leaves of involucre oblanceolate, 2.5–4.5 cm long, 6–9 mm wide; leaves of involucels 2, rounded at base oblong-ovate, acuminate or cuspidate, villous, the lower 1.6–3.7 cm long, 8–16 mm wide, the terminal reduced; cyathium turbinate, ca. 1.5 mm long and broad, glabrous, 383 outside, villous inside, with ovate truncate-fimbriate lobes; nectaries 4, transversely oblong; styles 2.5–3 mm long, nearly free, bifid; schizocarp flattened-globulose, 3–3.5 mm long, 4.5–5.5 mm wide, deeply trisulcate, slightly dotted-tuberculate, long spreading-hairy, with orbicular cocci; seeds globular, 2.2–2.5 mm long, smooth, bluish, brown-spotted, without appendage. May.

Clayey steppes, fallow fields, as a weed among crops. – Caucasus: S. Transc. Gen. distr.: E. Med. (N.), As. Min., Arm.-Kurd. Described from Asia Minor, from the lowlands of inner Caria south of Cadmus, among crops. Type in Geneva.

Subsection 3. *HELIOSCOPIAE* Prokh. subsect. nova. — Generis *Tithymali* sect. *Pseudokeraselmia* Prokh., *Obz. moloch. Sr. Azii* (1933) 119. — For characteristics of the subsection see Key on page 238. Type of subsection: *E. helioscopia* L.

Note. The pits on the seeds here are shallow, differing from the alveolate pits of *E. graeca* Boiss. et Sprun. The inclusion of the subsection in section *Tulocarpa* and not in section *Cymatospermum*, comprising the annuals, is based on the brown color of the seeds, the always hornless nectaries and the 3-branched peduncles.

52. *E. helioscopia* L. Sp. pl. (1753) 459; M. B. Fl. taur.-cauc. I, 378; Ldb. Fl. Ross. III, 562; Boiss. in DC. Prodr. XV, 2, 136; Fl. or. IV, 1107; Kom., Fl. Man'chzh. II, 692; Hegi, Ill. Fl. V, 1, 163; Krisht. in Fl. Yugo-Vost. V, 664; Prokh. in Izv. Akad. Nauk SSSR (1927) 209; Kryl., Fl. Zap. Sib. VIII, 1866. — *Tithymalus helioscopius* (L.) Scop. Fl. carn. ed. 2, I (1772) 337, nomen altern.; Prokh., *Obz. moloch. Sr. Azii*, 119. — *Galarhoeus helioscopius* (L.) Haw. Syn. pl. succ. (1812) 152. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 133, f. 4754; Hegi, Ill. Fl. V, 1, f. 1773; Prokh., *Obz. moloch. tabl. 35*. — Exs.: G. R. F. No. 233; Pl. Finl. exs. No. 800; Fl. exs. austro-hung. No. 3221.

Annual plants, sparingly hairy especially above, rarely glabrous; root thin, fusiform; stems 1–30, erect or spreading, (5)10–35(50) cm long, 1–4 mm thick, with basal leaf scars, simple; cauline leaves alternate, short-petiolate, cuneate at base, obovate or spatulate, 8–28 mm long, 5–13 mm wide, obtuse or truncate, often emarginate, denticulate above, laterally entire, glabrous, 1-nerved. Terminal peduncles 5, 0.5–4 (rarely up to 8.5) cm long, 3-branched and again forked once to thrice; leaves of involucre similar to the cauline in shape but larger, 1–3 cm long, 7–25 mm wide; lower leaves of involucels similar to upper cauline leaves, 3 in number, upper leaves 2, orbicular or elliptic; cyathium campanulate, 1.5–2.5 mm in
384 diameter, glabrous outside, slightly hairy inside, with oblong fimbriate lobes; nectaries transversely elliptic, greenish; styles nearly free, bifid; schizocarp turnip-shaped, 2.5–3.5 mm long, 3.4 mm wide, deeply trisulcate, with smooth orbicular cocci; seeds ovate, 1.5–2 mm long, brown, densely reticular-pitted, acuminate and flattened at apex, with disciform-transversely-oblong vertical appendage. April–August.

Weedy places, roadsides ditches, truck gardens, fallow lands, rarely among crops. — European part: Lad.-Ilm., Balt., U. V., V.-Kama, U. Dnp., U. Dns., M. Dnp., V.-Don, Bes., Bl., Crim., L. Don, L. V.; Caucasus: Cisc., Dag., W., E. and S. Transc., Tal.; Centr. Asia: Syr D., Pam.-Al., Mtn. Turkm., Amu D. Gen. distr.: Scand. (S.), Centr. and Atl. Eur., W. and E. Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him., Jap.-Ch., introduced into N. Am. Described from cultivated lands in Europe. Type in London.

Section 4. *CHYLOGALA* Prokh. sect. comb. nova. — Generis *Tithymali* subgen. *Chylogala* Prokh., *Obz. moloch. Sr. Azii* (1933) 57. — Subsect. *Carunculares* Boiss. in DC. Prodr. XV, 2 (1862) 111; Fl. or IV, 1084, 1093. Type of section: *Euphorbia bungei* Boiss.

Nectaries 5 (rarely 3 or 2), transversely oblong, hornless, truncate or pectinate or more or less bicornute; cyathium with conspicuous sometimes 2-lobed segments; styles not longer than $\frac{1}{4}$ the fruit, free, slightly 2-lobed; schizocarp large, conical-ovoid, long-stalked, pericarp not especially hard; seeds smooth, with erect and rarely recurved appendage; terminal peduncles 2-5 or cyathia solitary; leaves more or less incised-dentate or rarely subentire, palmately veined; stems strongly ribbed-striate, usually with leafy lateral shoots, commonly without axillary peduncles, glabrous and glaucous plants, sometimes more or less yellowish.

This apparently natural section with its rather special characteristics can be artificially subdivided into two subsections, both represented in the USSR.

Note. Some species (*E. bungei*, *E. ispahantica*) are characterized by distinct heterophylly.

Subsection 1. TIBETICAE Prokh. subsect. nova in Addenda XIII, 737.—
Type of subsection: *E. tibetica* Boiss.

Seeds with relatively small erect or recurved appendage, noticeably smaller than seeds; cyathium with emarginate 2-lobed segments and 5
385 transversely oblong, hornless or, in one case, long bicornute nectaries; stems branching, rarely simple, usually rather sparsely leafy; leaves more or less incised-dentate, generally scarious.

Distributed in the mountains of Middle and Central Asia, common in the subalpine and even alpine zones. In the west it does not extend beyond Kopet Dag.

Note. Morphologically, this is an extraordinarily variable subsection, indicating its great primitivity. Both rounded nectaries as well as sharply bicornute ones occur here, the cocci are smooth, but in one case they are tubercled with distinct processes.

53. *E. tibetica* Boiss. in DC. Prodr. XV, 2 (1862) 114; Prokh. in Izv. Akad. Nauk SSSR (1927) 198.—*Tithymalus tibeticus* (Boiss.) Prokh. comb. nova, nomen altern.

Perennial plants, glabrous, glaucous, often reddish; root thick, cylindrical, vertical, multicipital; stems many, procumbent below, 15-30 cm long (in high mountains 5-7.5 cm), strongly branching from base into sterile branches, only rarely with 1-2 axillary peduncles above (3-5 cm long), upper internodes elongate (5-7.5 cm); cauline leaves sessile, oblong-linear, 5-15 mm long, (1.5)2-4 mm wide, obtuse, acutely incised-dentate, rarely crenate. Terminal peduncles 3, 1.6-5.5 cm long, like the axillary ones 8-forked at summit or cyathia solitary; leaves of involucre and involucels 2, ovate-oblong, 1.2-4 cm long, 3-7 mm wide; cyathium subglobular, 1.5-2.5 mm long, 3-3.5 mm in diameter, with ovate, 2-lobed segments; nectaries 5, transversely oblong; styles 0.5 mm long, free, 2-lobed; schizocarp long-stalked, conical-ovoid, ca. 5 mm long, 4.5-5 mm wide, obtuse, hardly trisulcate, smooth; seeds compressed-oblong, 3-3.2 mm long, 1.7-1.8 mm wide, whitish, nearly smooth, with small obtuse conical recurved appendage. June—first half of July.

Mountain slopes in the alpine zone. — Centr. Asia: T. Sh. Gen. distr.: Ind.-Him. (N.), Dzu.-Kash. Described from the alpine zone of the NW Himalayas, from Dakkar and Piti. Type in London.

Note. *E. tibetica*, which is widespread in the high mountains of Central Asia and up to recently has been unknown within the USSR, has been unexpectedly discovered in the mountains of C. Tien Shan. It should now be included in the enumeration of species of *Euphorbia* of Central Asia recorded in 1933 in "Sistematicheskii obzor molochaev Srednei Azii" (Systematic Survey of Spurges of Central Asia).

- 386 54. *E. tranzschelii* Prokh., Obz. moloch. Sr. Azii (1933) 59. — *Tithymalus Tranzschelii* Prokh. *ibid.* nomen altern. — *T. issykkulensis* Prokh. l. c. 60. — Ic.: Prokh., l. c. tabl. 8 and 9.

Perennial plants, glaucous or yellow-green, glabrous, 5–15 cm high; root thin, creeping, multicapital; stems rather many, prostrate, strongly branching from base; cauline leaves subsessile, rounded at base, oblong-elliptic or ovate-lanceolate, 4–20 mm long, 3–9 mm wide, obtuse or cuspidate, more or less acutely dentate, leaves on sterile branches smaller and numerous. Terminal peduncles 3, simple, with solitary cyathia at apex, often, however, developing sterile shoots; leaves of involucre ovate-lanceolate, slightly larger than the cauline; leaves of involucels similar to cauline leaves, ovate-lanceolate; cyathium subglobular, 1.5–2 mm long, 2.5–3.5 mm in diameter, with emarginate 2-lobed glabrous segments; nectaries transversely oblong, yellow-brown; styles ca. 1 mm long, free; schizocarp conical-ovoid, 4.5–5.5 mm long, obtuse, smooth, on 5–8 mm long stalks; seeds compressed-ovate, 3–4 mm long, smooth, grayish-glaucous, faintly striate, with oblong-conical somewhat recurved appendage. Fl. May–June; Fr. June.

River valleys and shores of lakes (possibly in damp places?). — Centr. Asia: T. Sh. (Rybach'e near Lake Issyk-Kul), Pam.-Al. (Irkeshtamka River near Irkeshtam). Endemic. Described from Irkeshtamka River. Type in Leningrad.

Note. An unusually interesting and, apparently, rare species known only from two localities. Originally (1933) the author described two species, *E. tranzschelii* and *E. issykkulensis*, from each of these localities; the described differentiating characters, however, proved to be clearly inadequate to distinguish them as separate species, all the more so since they were collected not too far from each other within the same mountain system of Tien Shan.

I am retaining the name *E. tranzschelii* for the united species, since in spite of being incompletely described, it still represents the earlier collection. I also want to honor Transchel's memory whose work on rust fungi contributed considerably to recognizing the species of *Euphorbia*.

55. *E. bungei* Boiss. Prodr. XV, 2, (1862) 115; Fl. or. IV, 1095; O. and B. Fedch., Perech. r. Turk. VI, 305. — *Tithymalus Bungei* (Boiss.) Prokh., Obz. moloch. Sr. Azii (1933) 62, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 65; Prokh. l. c. tabl. 10.

Perennial plants, 20–40 cm high, gray-green or sometimes yellowish above, glabrous; root thin, creeping; stems in tufts of few, erect, densely leafy, nearly not branching; basal leaves squamiform, acutely triangular, deciduous; cauline leaves sessile, cordate-amplexicaul at base, variable in shape, shortly ovate-triangular to linear, 1.5–10 cm long, 1–3 cm wide, acuminate, cuspidate or obtuse, acutely dentate, rarely subentire. Terminal peduncles 3-forked 2–3 times; leaves of involucre similar to the upper cauline leaves, sometimes just slightly larger; leaves of involucels 2, triangular-ovate, obtuse, yellowish; cyathium broadly campanulate, 4–5 mm in diameter, slightly hairy inside, with large spatulate acutely 2-lobed segments; nectaries transversely elliptic, sometimes somewhat obtuse; styles ca. 1 mm long, nearly free, shortly 2-lobed; schizocarp ovoid, 5–6 mm long, trisulcate, with orbicular, smooth or hardly rugose cocci; seeds ovate, 3–4 mm long, greenish-white, appendage erect, stalked, conical, sulcate, notched. Fl. April–first half of May, Fr. June.

Stony, often turfed mountain slopes, sometimes steppes of feather grass.—Centr. Asia: Mtn. Turkm. (Kopet Dag Range, Greater Balkhan). Gen. distr.: Iran. (N.). Described from near Shakhrud and Sebzewar in N. Iran. Type in Geneva.

Note. Typified with a distinct heterophylly, due to the polymorphism of the leaves.

56. *E. schugnanica* B. Fedtsch. in O. and B. Fedch., Perech. r. Turk. VI (1916) 307.—*Tithymalus schugnanicus* (B. Fedtsch.) Prokh., Obz. moloch. Sr. Azii (1933) 64, nomen altern.—*l. c.*: Prokh. l. c. tabl. 11.

Perennial low gray-green glabrous plants; root creeping cylindrical, producing suckers; stems many, spreading below then ascending, 5–15 cm long, densely leafy, branching, bearing above solitary axillary peduncles; basal leaves rather small, the cauline short-petiolate, slightly cordate at base, triangular-ovate or suborbicular, 0.8–1.5 cm long, 0.7–1 cm wide, obtuse, undulate and acutely dentate at margin. Terminal peduncles 2–5 (usually 3), like axillary peduncles simple; leaves of involucre cordate at base, orbicular-triangular, 0.8–1.2 cm long, 0.8–1.4 cm wide, obtuse; leaves of involucels smaller; cyathium subglobular, 3–4 mm in diameter, with narrow emarginate 2-lobed segments; nectaries transversely oblong, truncate, brownish-black; styles ca. 0.5 mm long, shortly 2-lobed; schizocarp conical, truncate 6–7 mm long, 5–6 mm wide, slightly trisulcate, cocci beset at first with a row of elongate processes, later becoming partly naked and only sparingly tuberculate-verrucose, glabrous; seeds ovate, ca. 5 mm long, smooth, whitish, with greenish longitudinal stripes. Fl. June–July, Fr. August.

388 Rock debris on slopes in the subalpine zone.—Centr. Asia: Pam.-Al. (Shugnan, Darvaza). Endemic. Described from Shugnan, from the lower reaches of Abkharv River. Type in Leningrad.

Note. Distinguished from the other species in the section *Chylogala* by its tuberculate-verrucose fruits.

57. *E. turkestanica* Rgl. Descr. pl. nov. Fedtsch. (1882) 78, non Franch.; Prokh. in Izv. Akad. Nauk SSSR (1927) 197. — *Tithymalus turkestanicus* (Rgl.) Prokh., Obz. moloch. Sr. Azii (1933) 66, nomen altern. — Ic.: Prokh., Obz. moloch. tabl. 12. — Exs.: H. F. A. M. No. 306.

Annual plants, 6–17 cm high, glaucous, glabrous; root thin, vertical; stems erect; cauline leaves sessile, obtuse, varying in shape, cotyledons linear and entire, lower leaves opposite, ovate and dentate, the upper alternate, slightly cordate at base, ovate, acutely dentate, 3-nerved. Terminal peduncles 3, forked a few times; leaves of involucre similar to upper cauline leaves but larger (1.5–2.5 cm long, 1–2 cm wide); leaves of involucels 2, elliptic-lanceolate, 1.5–3 cm long, 0.6–1.8 cm wide, obtuse, dentate; cyathium subglobular, up to 2 mm in diameter, glabrous, lobes small, emarginate, bidentate, glabrous; nectaries 5, transversely linear-oblong, more or less rounded or rarely obtuse; styles 0.8–1.2 mm long, nearly free, weakly 2-lobed; schizocarp ovoid, truncate, 5–6 mm long, trisulcate; seeds compressed-ovate, 3–4 mm long, spotted, green-brown, appendage erect, stalked, transversely reniform, concave above, 2-lobed below. Fl. April, Fr. May.

Weedy places and dry steppical slopes. — Centr. Asia: Balkh. (Kurdy River near the Kopa valley mouth), T. Sh. (Atbashskaya Botanical Station), Syr D. (Andizhan between Kosharal and Chardara, between Kosharal and Keles), Pam.-Al. (Ziaeddin village, Katta-Kurgan, Samarkand), Mtn. Turkm. (Ashkhabad, Keshi). Gen. distr.: Dzu.-Kash. (Kuldja district between Suiting and Ili River). Described from Katta-Kurgan. Type in Leningrad.

Note. A weed widely but sporadically distributed in the foothills of Turkestan. It occupies a rather unique position in the section *Chylogala* being the only known annual in the subsection.

58. *E. alaica* Prokh., Obz. moloch. Sr. Azii (1933) 57. — *Tithymalus alaicus* Prokh. ibid. nomen altern.

389 Perennial plants, 30–75 cm high, glabrous, glaucous; root thin, cylindrical, creeping; stems single or few, erect, 4–7 mm in diameter, sulcate-ribbed, with sparse leaf scars below, leafy above, simple or with sterile leafy branches, bearing 1–2 axillary peduncles (4.5–5 cm, then up to 15 cm long); cauline leaves sessile, more or less deeply cordate-subamplexicaul at base, oblong-triangular or oblong, 1.8–7 cm long, 0.8–1.7 cm wide, widest below middle, obtuse or cuspidate, usually entire, only at base slightly acutely dentate, fleshy, obscurely 1-nerved; leaves on sterile branches linear or linear-lanceolate, 1.5–2 cm long, 2–5 mm wide, somewhat acuminate. Inflorescence 8–25 cm high; terminal peduncles (4)5(6), 5–8(9) cm long, twice to thrice forked; leaves of involucre rounded at base, rhombic-lanceolate or triangular-ovate, 2.8–6 cm long, 1.7–2.5 cm wide, obtuse, subentire or serrate; leaves of involucels 2, sessile, strongly asymmetrical at base, obscurely palmately veined, the lower rhombic-ovate or rhombic-reniform, 1.4–2(4) cm long, 1.5–2(3.5) cm wide, the upper reduced, obliquely ovate, more than twice as long as broad; cyathium campanulate, 3–4 mm in diameter, glabrous, with triangular-lanceolate (1–1.5 mm long) often 2-lobed segments; nectaries biscuit-shaped, slightly emarginate, bicornute, with spatulate horns not shorter than width of nectary; styles 1.5–2 mm long, nearly free, 2-lobed; schizocarp conical, truncate, ca. 6 mm

long, smooth; seeds ovate, 3–4 mm long, smooth, whitish, striate, with erect appendage. Fl. June? Fr. August.

Calcareous soils in river valleys. — Centr. Asia: Pam.-Al. (Turkestan Range, basin of Isfara River; Chatkal Range, basin of Kasansai River and Uridei River valley). Endemic. Described from Dzhida-Bulak gorge near Isfar River basin in Alai Range. Type in Leningrad.

Note. A rare and little-known species, found only in a few, markedly separate localities. It has been described from unsatisfactory deflorate specimens. It should be further studied by collecting more worthwhile material and looking for new localities.

It is also of interest being the only representative of the subsection *Tibeticae* with long, bicornute nectaries. In habit it is very similar to the Transcaucasian *E. ispahanica* Boiss. of the subsection *Carunculares*, but is readily distinguishable by the shorter appendage on the seeds.

It is quite possible that, as in the case of *E. franchetii* B. Fedtsch., we are dealing here with a Central-Asian hybrid form between the native species of subsection *Tibeticae*, with rounded, hornless nectaries, and the invading intrusive forms of *Carunculares*, similar to *E. ispahanica*, with nectaries more or less bicornute.

Subsection 2. *CARUNCULARES* Boiss. in DC. Prodr. XV, 2 (1862) 111; Fl. or. IV, 1084, 1093. — Type of subsection: *Euphorbia ispahanica* Boiss.

390 Seeds with large rather sulcate appendage often larger than seeds; nectaries 5 or sometimes only 3 or even 2, more or less bicornute or hornless, only truncate or pectinate; stems simple or branching, sometimes rather densely leafy; leaves fleshy, more or less incised-dentate or entire.

Distributed within the broad range of the Mediterranean area; the species occupy lowland steppes and deserts and distinctly avoid mountains.

59. *E. ispahanica* Boiss. Diagn. ser. 1, VII (1846) 91. — *E. coriacea* C. Koch in Linnaea, XXI (1848) 730. — *E. megalantha* auct.; Boiss. in DC. Prodr. XV, 2 (1862) 111; Fl. or. IV, 1093, p. p. non Boiss. (1846). — *Tithymalus ispahanicus* (Boiss.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 89, nomen altern. — Ic.: Boiss. Ic. Euph, tab. 59. — Exs.: Herb. fl. caus. No. 335 ("*E. megalantha*").

Perennial plants, 30–50 cm high, glabrous, more or less glaucous; stems ascending below, rather thick (3.5 mm), ribbed-striate, branching below with sterile branches, without axillary peduncles (very rarely with 1); cauline leaves sessile, linear or lanceolate, 2.5–8.5 cm long, 0.3–2 cm wide, acute, entire or slightly dentate, fleshy, parallelly 3–(5-) veined, with a prominent midrib, leaves on sterile branches narrowly linear, ca. 5 cm long, 1.5–2 mm wide. Terminal peduncles 3–5(6), 2.5–10 cm long, furcate many times; leaves of involucre obliquely lanceolate, 1.2–6 cm long, 0.6–2.2 cm wide; leaves of involucels 2, dilated at base, obliquely oblong-lanceolate, acute, the lower 1.4–3.5 cm long, (0.5)1–1.7 cm wide, the terminal reduced;

cyathium subglobular, 4–5 mm in diameter, glabrous, lobes 5, narrowly linear, 2–2.5 mm long, entire; nectaries (2)3, large, trapeziform, truncate, short bicornute or pectinate; styles 1.5–2 mm long, connate at base, shortly 2-lobed; schizocarp long-stalked, oblong, 7–8 mm long, 5.5–6 mm wide, deeply trisulcate, with orbicular cocci; seeds ovate, whitish, appendage large, ovate-conical, multisulcate, stalked, notched. Fl. May, Fr. second half of May–June.

Gravels in valleys and dry places. — Caucasus: S. Transc. (Araks River valley). **Gen. distr.:** Iran. Described from near Isfahan. Type in Geneva.

Note. This extremely polymorphic species varies considerably in number of terminal peduncles and in shape of the leaves, often displaying heterophylly even only on the main stem. It is very sharply distinguished morphologically by the length of the cyathium lobes, reduced number of nectaries and the shape of the appendage on the seed.

- 391 60. *E. grossheimii* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 551. — *E. Mariae* Tamamsh. in Dokl. Akad. nauk Arm. SSR, I (1944) 44. — *Tithymalus Grossheimii* Prokh. l. c. nomen altern.

Glaucous annual plants, 4–10 cm high; root thin, vertical; stems erect, rounded below, sulcate-ribbed above; cauline leaves alternate, the lower abruptly expanded at base, obovate, 4–10 mm long, ca. 2 mm wide, obtuse, distinctly acutely toothed, the upper sessile, obliquely rounded at base, linear, up to 4 cm long, 2–3 mm wide, usually subacute, entire, with 3 obscure parallel veins. Terminal peduncles 2–3, once or twice forked; leaves of involucre linear, entire or ovate-lanceolate, long-acuminate; leaves of involucels, obliquely rounded at base, ovate-lanceolate, widest below middle, cuspidate or obtuse, acutely toothed at margin (especially in the upper part); cyathium 1–1.5 mm long and broad, segments elongate (up to 0.5 mm), deeply emarginate, acutely 2-lobed, hardly ciliate; nectaries 5, narrow, biscuit-shaped, truncate or slightly emarginate outside, sometimes short-bicornute (with filiform horns); styles ca. 1 mm long, nearly free; schizocarp conical-ovoid, 6–8 mm long, 5–7 mm wide, slightly trisulcate, smooth; seeds globular, smooth, usually spotted, greenish-white, longitudinally striate, appendage conical, pale yellow, stalked, 2-lobed below, deeply notched, longer than seeds (4 mm long, 2 mm wide). May–(June).

Dry hills and in steppes. — Caucasus: S. Transc. (Nakhichevan ASSR). Endemic? Described from the vicinity of Nakhichevan on Iranian border. Type in Leningrad.

Section 5. *MURTEKIAS* (Raf.) Prokh. ampl. sect. comb. nova in Addenda XIII, 737. — *Murtekias* Raf. Fl. tellur. (1938) 116, ampl. — For characteristics of the section see Key on page 322. Type of section: *Euphorbia myrsinites* L.

Note. A Mediterranean section, being accordingly xerophytic so that the leaves are succulent. In the USSR it is represented in three subsections.

Subsection 1. PARALIOIDEAE Prokh. subsect. nova in Addenda XIII, 738. — For characteristics of subsection see Key on page 247.

Note. An apparently monotypic subsection.

61. *E. paralias* L. Sp. pl. (1753) 458; Boiss. in DC. Prodr. IV, 2, 167; Fl. or. IV, 1130. — *Tithymalus paralias* (L.) Scop. quoad nomen, Fl. carn. ed. 2, I (1772) 338, nomen altern. — Ic.: Jacq. Hort. Vindob. tab. 188; Engl. Bot. tab. 195; Rchb. Ic. Fl. Germ. V, tab. 145, f. 4789. — Exs.: Herb. Fl. Gauc. No. 483.

392 Perennial plants, 38–50 cm high, glabrous, glaucous; root branching, long, multicapital; stems many, erect, firm, densely and imbricately leafy, becoming naked below, with numerous leaf scars, bearing above 6–8 axillary peduncles (ca. 1.5 cm long); cauline leaves fleshy, entire, the lower shorter, linear-elliptic, obtuse, the upper oblong, (1.1) 1.3–2.5 cm long, 2.5–5(8) mm wide, acute, leaves on branches smaller, nearly filiform, (0.7) 1–3.2 cm long, 0.8–1.1 mm wide. Terminal peduncles 3 or 5, thick, 0.7–3.2 cm long, like axillary peduncles forked for 2– to 3 times; leaves of involucre cordate at base, ovate, 1.2–1.6 cm long, 3–6 mm wide; leaves of involucre 2, cordate at base, reniform, short-cuspidate, the lower 0.7–1.3 cm long, 0.7–1.3 cm wide; cyathium broadly campanulate, 2–2.5 mm long and broad, hairy inside, with oblong ciliate lobes; nectaries crescent-shaped, with short divergent horns; styles ca. 1 mm long, nearly free, 2-lobed; schizocarp turnip-shaped, 3.5–4.5 mm long, 5–6.5 mm wide, much flattened, deeply trisulcate, with convex, finely tuberculate cocci; seeds ovate-globular, 2.8–3 mm long, 2.2–2.5 mm wide, whitish, smooth, very sparingly dark-pitted, with small flattened-reniform appendage. Fr. July–August.

Sandy seashores. — European part: Crim.; Caucasus: W. Transc. Gen. distr.: Atl. Eur., Med., Bal.-As. Min. Described from sandy seashores of Europe. Type in London.

Subsection 2. CONICOCARPAE Prokh. subsect. nova. — Generis *Tithymali* sect. *Conicocarpus* Prokh., Obz. moloch. Sr. Azii (1933) 155. — Generis *Galarhoei* sect. *Conicocarpus* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 38. — For characteristics of the subsection see Key on p. 247. Type of subsection: *Euphorbia seguieriana* Neck.

A Mediterranean subsection. Divided in the USSR into two series.

Series 1. *Seguierianae* Prokh. — For characteristics of the series see Key on page 247. Type of series: *Euphorbia seguieriana* Neck.

62. *E. petrophila* C. A. M. Kleine Beitr. (1850) 9; Boiss. in DC. Prodr. XV, 2, 150; Fl. or. IV, 1118. — *E. saxatilis* auct.; M. B. Fl. taur.-cauc. I (1808) 373, III, 325, non Jacq. — *E. nicaeensis* β . minor Ldb. Fl. Ross. III (1851) 573. — Ic.: Boiss. Ic. Euph. tab. 101. — Exs.: G. R. F. No. 1087; Herb. Norm. No. 5170.

(393)



PLATE XX. 1—*Euphorbia alata* Boiss.; 2—*E. wittmanni* Boiss.; 3—*E. coniosperma* Boiss. et Buhse.; 4—*E. talastavica* Prokh.; 5—*E. squamosa* Willd.

395 Perennial plants, (3)6–22 cm high, usually very finely glandular-velutinous, glaucous; root multicapital; stems numerous, fertile and sterile, low, ascending or erect, hardening at base, 1–2 mm in diameter, becoming naked, with many leaf scars, simple, only above sometimes with 1–6 axillary peduncles (0.5–2 cm long); cauline leaves sessile, more or less rounded at base, linear-oblong or oblong-oblancheolate or oblong-lanceolate, (3.5)5–15(22) mm long, (1)2.5–4(6.5) mm wide, 2 to 4(5) times longer than wide, the upper wider, cordate at base, triangular-ovate or triangular-lanceolate or oblong, 6–13(17) mm long, 5–6(8) mm wide, $1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide, all leaves usually obtuse, very finely crenate or subentire at the narrowly cartilaginous margin, dense, glaucous, uninterruptedly pitted-dotted, usually slightly glandular-velutinous, later glabrous, with obscure longitudinal midrib, sometimes with 2 more short lateral ones; leaves on sterile branches spatulate or linear-oblancheolate, 0.9–2.3(3) cm long, 2–4(7) mm wide, 5 to 7(8) times longer than wide. Terminal peduncles (1)3–5(8), 0.3–2.5 cm long, like axillary peduncles simple or once forked at summit; leaves of involucre rounded or more or less cordate at base, orbicular or triangular-reniform or triangular-ovate, 5–15 mm long, 4–15 mm wide, approximately as long as wide or $1\frac{1}{2}$ times longer than wide and v. v., obtuse or short-cuspidate; leaves of involucels 2, truncate or more or less cordate at base, reniform-suborbicular or rhombic-reniform or orbicular-rhombic, the lower 4–10 mm long, 5–14 mm wide, slightly or distinctly (up to 2 times) longer than wide, obtuse, abruptly short-cuspidate, often finely crenate, rather pale; cyathium campanulate, 2–2.5 mm in diameter, hairy inside, with lobes ovate, obtuse, bifid or trifid, fimbriate-ciliate; nectaries crescent-shaped, with short spatulate horns; styles (1)1.5–2 mm long, connate for one-third, bifid; schizocarp ovoid, 2.5–3.5 mm long, 1.8–2.5 mm wide, obscurely sulcate, smooth, with orbicular cocci; seeds compressed-ovate, tetrahedral, whitish, densely pitted-dotted, with conical appendage. Fl. May–June, Fr. June – first half of July. (Plate XXI, Figure 4.)

Calcareous soil or chalky rocks and stones on slopes. – European part: Crim., L. Don (Donets River in the west); Caucasus: Cisc. (Mashuk Mountain), W. Transc. (N.). Endemic. Described from the Crimea. Type in Leningrad.

63. *E. seguieriana* Neck. in Acta Akad. Theod. Pal. II (1770) 493; Hegi, Ill. Fl. V, 1, 177; Kryl., Fl. Zap. Sib. VIII, 1872. – *E. Gerardiana* Jacq. Fl. austr. V (1778) 17; M. B. Fl. taur.-cauc. I, 379; Ldb. 396 Fl. Ross. III, 569; Boiss. in DC. Prodr. XV, 2, 166; Fl. or. IV, 1124; Korsh. Tent. Fl. Ross. or. 375; Krisht. in Fl. Yugo-Vost. V, 665. – *E. firma* Ldb. l. c. 563. – *Tithymalus Seguierianus* (Neck.) Prokh., Obz. moloch. Sr. Azii (1933) 163 ("*Seguierianus*"), nomen altern. – *T. Gerardianus* Steud. Nomencl. ed. 2, II (1841) 689. – *Galarhoeus Seguierianus* Prokh. in Trud. Kuibysk. Bot. Sada, I (1941) 41, olim. – Ic.: Jacq. l. c. tab. 438; Rechb. Ic. Fl. Germ. V, tab. 147, f. 4794; Hegi, Ill. Fl. V, 1, tab. 178, f. 4 et f. f. 1787, 1788; Prokh., Obz. moloch. tabl. 54. – Exs.: G. R. F. No. 1184 ("*E. Gerardiana* Jacq. f. *arenaria* Litw.") No. 1185 ("*f. rupestris* Litw."). –

Perennial plants, 12–55 cm high, glabrous, glaucous; root cylindrical, vertical or obliquely descending, multicipital; stems sterile and fertile, branching only at base, erect, sometimes only half of the plant length, virgate, dead stems long persistent, naked in the lower part (1.5–5 mm thick), with leaf scars, generally densely leafy, bearing above 1–11 axillary peduncles (3–6.5 cm long) without sterile branches, basal leaves small, squamiform; cauline leaves subsessile, broadly linear, the lower spatulate-linear or linear-lanceolate or (the upper) ovate-lanceolate, 1.3–2.5(2.8) cm long, 1.5–4(10) mm wide, obtuse, abruptly cuspidate or often acuminate (especially the upper), entire, thick, with obscure parallel nerves and barely distinct lateral ones, glabrous, enveloping above each other, leaves on sterile shoots generally (2.5–3.5 cm). Terminal peduncles 5–12, 1.8–6 cm long, like axillary peduncles forked for 1–3 times, rarely forming monochasial bostrices due to lack of development of one of the branches of the forked cyme but still with 2 leaves of involucels in each node; leaves of involucre rounded at base, ovate-lanceolate or linear-lanceolate or rhombic-ob lanceolate, 7–14 mm long, 3–7 mm wide, acute, parallelly 3-nerved; leaves of lower involucels usually slightly cordate at base, triangular-ovate or reniform, 3–8 mm long, 4–10(12) mm wide, cuspidate, in upper involucels strongly reduced, orbicular-rhombic; cyathium campanulate, 2.5–3 mm long, 1.5–2 mm in diameter, glabrous outside, hairy inside, lobes triangular-ovate or orbicular, acute or truncate, more or less ciliate lobes; nectaries transversely oblong, 0.7–1 mm wide, usually not more than $1\frac{1}{2}$ times longer than wide, obtuse-truncate, hornless; styles 1.5–2 mm long, connate at base, bifid; schizocarp conical-ovoid, 3–4 mm long, 2.5–3.5 mm wide, slightly trisulcate, orbicular at cross section, nearly smooth, indistinctly papillate, glabrous; seeds compressed-ovate, 2.3 mm long, whitish, nearly smooth, sometimes hardly pitted, with sessile conical incurved appendage. Fl. second half of May – June – July, Fr. second half of June, July (rarely first half of August).

- 397 Sands (sometimes shifting sand – f. *arenaria* Litw.), also on stony slopes (f. *rupestris* Litw.), calcareous and chalks, feather-grass mixed with herbs and shrubby steppes, sometimes fallow fields and pastures and also river gravels. – European part: U. Dnp. (S.), M. Dnp. (except for north), Bl., Crim., V.-Don (SW) and SE), L. Don, L. V., Transv.; Caucasus: Cisc., Dag., E. and S. Transc.; W. Siberia: U. Tob. (except for northeast); Centr. Asia: Ar.-Casp., Balkh. (along Sary-Su River in the west), Kyz. K. (lower reaches of Syr Darya River in the north), Mtn. Turkm. (Greater Balkhan Range in the west). Gen. distr.: Centr. Eur. Described from Austria.

64. *E. humilis* C. A. M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 25; Fl. alt. IV, 185; Fl. Ross. III, 561; Boiss. in DC. Prodr. XV, 2, 153; Kryl., Fl. Zap. Sib. VIII, 1873. – E. Korovini Pavl. in Byull. Mosk. obshch. isp. pr. Nov. ser. XLII (1983) 126, 129. – *Tithymalus humilis* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 67, nomen altern.; Prokh., Obzor. moloch. Sr. Azii, 160. – Ic.: Ldb. Ic. pl. Fl. Ross. tab. 187; Prokh. l. c. tabl. 53.

Perennial plants, 3–15 cm high, glaucous or yellowish-green; root vertical, cylindrical, multicipital; stems many, fertile and sterile, often woody at base and more or less branching, erect or ascending, glabrous

or sometimes short-velutinous-hairy, simple above base, even without axillary peduncles; leaves of fertile stems loosely disposed (with internodes longer than half of the adjacent leaf), rounded at base, oblong or elliptic or sometimes (especially the upper) orbicular, 6–12 mm long, 4–7 mm wide, $1\frac{1}{2}$ to 2 times (rarely up to 3) longer than wide, obtuse, cartilaginous at margin, entire, coriaceous, glabrous, with 1 inconspicuous nerve; leaves of sterile stems more tightly disposed (often 4–5 times longer than internodes), narrowly lanceolate or oblong-ob lanceolate, 7–17 mm long, 2–4 mm wide, $3\frac{1}{2}$ to 5 times longer than wide, acuminate or more or less cuspidate, 1-nerved. Terminal peduncles (1)2–4(5), simple, 0.5–1.5 cm long; leaves of involucre 3–4 (rarely 5), elliptic or obovate or orbicular, 5–12(18) mm long, 4–11 mm wide, as long as wide or more or less (up to $1\frac{3}{4}$ times) longer, obtuse, sometimes short-cuspidate; leaves of involucels 2, orbicular or broadly rhombic-ovate, 3–7 mm long and wide, obtuse or short-cuspidate, 1-nerved; cyathium campanulate, 1.5–2 mm in diameter, glabrous, with ovate ciliate lobes; nectaries reddish, transversely oblong, obtuse-truncate; styles 1.5–2 mm long, connate for one-third, bifid; schizocarp conical-ovoid, 3.5–4 mm long, 2.5–3 mm wide, nearly not sulcate, orbicular at cross section, smooth; seeds compressed-tetrahedral-ovate, 2–2.5 mm long, obscurely pitted, with obtuse conical appendage. Fl. June – first half of July, Fr. first half of June – July.

Rocks and stony slopes, foothills (up to the subalpine belt), steppe formations. — N. Siberia: Irt.; Centr. Asia: Ar.-Casp. (E.), Balkh., T. Sh., (Talass Ala-Tau and Syr Darya Kara-Tau ranges in the west), Pam.-Al. (Turkestan Range in the northwest), Mtn. Turkm. (Central Kopet Dag: Chapan-Dagh Mountain). Endemic? Described from Dzungaria, Dzhigilen Mountain. Type in Leningrad.

Note. An examination of collections of this species from different parts of its distribution area revealed that N. V. Pavlov was not justified in separating the specimens from the northwestern spurs of Tien Shan into an independent species (*E. korovini*). On checking the characters noted in the description it was found that they are not specific to the plants in the area of *E. korovini*. The major character — number of leaves of the involucre which corresponds exactly to the number of terminal peduncles, 5 in *E. korovini* and 3 in *E. humilis* — is itself inaccurate: normally *E. humilis* has 4 terminal peduncles, and plants with 5 peduncles were observed far beyond the distribution area which Pavlov attributed to his species. Less reliable is the color of the plant, ranging from yellowish-green to glaucescent-gray, depending on the degree of moisture; in the given case the color yellow-green has been observed throughout the entire area of this species. The same applies to the size and shape of the fruit and seeds, both displaying completely natural variations. For all these reasons *E. korovini* Pavl. cannot be accepted as a separate species.

65. *E. kopetdaghi* Prokh., Obz. moloch. Sr. Azii (1933) 158. — *E. Fuhsii* Boram. et Sint. ex O. and B. Fedch. (nomen) Perech. r. Turk. VI (1916) 310. — *Tithymalus kopetdaghi* Prokh. l. c. nomen altern. — Ic.: Prokh. l. c. tabl. 52.

Perennial plants, 15–40 cm high, glabrous, glaucous; rhizome thickly cylindrical, obliquely descending; stems rather many, erect, virgate, slightly branching, with basal lateral shoots and above with only few axillary peduncles; cauline leaves sessile, distinctly rounded and slightly amplexicaul at base, lanceolate-elliptic or linear-lanceolate, 1–8 cm long, 3–13 mm wide, acuminate or rarely cuspidate, cartilaginous at margin, hardly dentate, 3-nerved, sometimes with indistinct lateral nerves. Terminal peduncles 5, up to 6 cm long, like axillary peduncles simple or shortly furcate; leaves of involucre ovate-oblong or triangular-ovate or rarely lanceolate, 1–2.5 cm long, 0.4–1.6 cm wide; leaves of involucels 2, transversely rhombic-oblong or ovate-rhombic, 4–10 mm long, 4–12 mm wide, cuspidate, bright yellow at anthesis; cyathium campanulate, 2–2.5 mm long, 2.5–3 mm in diameter, glabrous outside, hairy inside, with orbicular, dentate, ciliate lobes; nectaries crescent-shaped, truncate or slightly crested, yellowish, usually short-bicornute; styles 1.5 mm long, half-connate, bifid; schizocarp ovoid-conical, 4.5–5.5 mm long, 4–5 mm wide, hardly trisulcate, orbicular at cross section smooth; seeds compressed-oblong, 3–4 mm gray, distinctly pitted, with small orbicular-conical long-stalked appendage. Fl. second half of May – first half of June, Fr. second half of June – first half of July.

Steppe slopes. – Centr. Asia: Mtn. Turkmen. Gen. distr.: Iran (at the northern frontier). Described from Kopet Dag Range between Kargile and Nukhur villages. Type in Leningrad.

Note. It is interesting to note the absence of this species in the Balkans where it is replaced by *E. seguieriana* Neck.

66. *E. sogdiana* M. Pop. in Tr. Turk. Nauchn. Obshch. (1923) 38. – *Tithymalus sogdianus* (M. Pop.) Prokh., Obz. moloch. Sr. Azii (1933) 156, nomen altern. – Ic.: Prokh. l. c. tabl. 54.

Perennial plants, 15–60 cm high, glabrous, glaucous; root cylindrical, horizontal or obliquely descending; stems erect, usually branching (especially at base) mainly into sterile shoots and with a few axillary peduncles above; cauline leaves sessile or sometimes hardly petiolate, more or less dilated-triangular or nearly cordate and slightly amplexicaul at base, narrowly elliptic or linear-oblong or ovate-lanceolate, 1.8–5 cm long, 5–15 mm wide, obtuse or rarely slightly cuspidate, cartilaginous at margin, denticulate, coriaceous, 3–5-nerved. Terminal peduncles (3)4–5, 3–7 cm long, like axillary peduncles simple or forked for 1–2 times; leaves of involucre dilated and slightly cordate at base, broadly ovate or oblong-lanceolate, 1.5–4 cm long, 0.8–2.3 cm wide, obtuse or short-cuspidate, finely crenate, 5–7-nerved; leaves of involucels 2, slightly cordate at base, orbicular or ovate-reniform, 5–22 mm long, 5–24 mm wide, obtuse or short-cuspidate, yellowish at anthesis; cyathium broadly campanulate, 3–4 mm in diameter, glabrous outside, slightly hairy inside, with small orbicular glabrous dentate lobes; nectaries crescent-shaped, large (2–2.5 mm), yellowish, emarginate outside, bicornute, with horns barely wider than nectaries; bracts of pistillate flowers pinnate; styles up to 2 mm long, half connate, bifid; schizocarp ovoid-conical, 5–6 mm long, 4–5 mm wide, hardly trisulcate, orbicular at cross section, smooth; seeds ovate, 3.5–4.5 mm long, pitted, with small orbicular-conical stalked appendage. Fl. June, Fr. July.

400 Dry mountain slopes, calcareous-clayey soil. — Centr. Asia: Pam.-Al. Endemic. Described from Dzhaus village near Kitab (Uzbekistan). Type in Tashkent.

Note. The elongation of the rays of the cymose umbels in the later specimens, as noted by Popov, is not limited to this species, it also occurs in *E. seguieriana* Neck., *E. stricta* L. and others.

Series 2. *Nicaeenses* Prokh. — For characteristics of the series see Key on page 248. Type of series: *Euphorbia nicaeensis* All.

67. *E. macroclada* Boiss. Diagn. ser. 1, V (1844) 54. — *E. schizoceras* Boiss. ibid. 55. — *E. syspirensis* C. Koch in Linnaea, XXI (1848) 725. — *E. damascena* Boiss. Diagn. ser. 1, XII (1853) 112. — *E. tinctoria* Boiss. et Huet ex Boiss. in DC. Prodr. XV, 2 (1862) 166; Fl. or. IV, 1129. — *Tithymalus macrocladus* (Boiss.) Prokh. comb. nova, nomen altern.

Perennial plants, 30–45 cm high, more or less yellowish, farinaceous-pubescent (under magnification); root thick, producing many elongate creeping shoots; stems many, ascending, thick (5–6 mm below), hard, whitish, striate-furrowed, leafy, above with 4–14 axillary peduncles (2.5–7 cm long), without sterile branches; cauline leaves dense (5 to 10 times longer than internodes), sessile, cuneate at base oblanceolate, (3.2)4–7.5 cm long, 4 to 6 times longer than wide, (0.7)0.8–1.5 cm wide, acute and acuminate, entire, coriaceous, flexuous, glaucescent, palmately 3–5-nerved, with veins protruding beneath. Inflorescence paniculate; terminal peduncles 5–8, like axillary peduncles yellowish, once or twice bifurcate; leaves of involucre sessile, slightly tapering at base, oblong-lanceolate or rhombic-deltoid, 1.2–2.7(3.7) cm long, 1–1.8 cm wide, about as long as wide or often much longer (up to 3 times), acute; leaves of involucels 2, rounded or only slightly cordate at base, reniform or triangular-reniform, 7–10 mm long, 12–18 mm wide, usually $1\frac{1}{2}$ to 2 times wider than long, acute or obtuse, usually mucronate, yellow; cyathium turbinate, 3–3.5 mm long, 3.5–4 mm in diameter, villous inside, lobes ovate, truncate or emarginate, dentate, with bifurcate nerve; nectaries orange, crescent-shaped, emarginate or pectinate at margin, bicornute, with horns shorter than width of nectary, often obtusely and palmately 2–5-lobed or 2-partite; styles 2.5–3.5 mm long, half-connate, shortly bifid; schizocarp conical-ovoid, ca. 5 mm long, 1 mm wide, inconspicuously sulcate, smooth or (especially when young) white-velutinous, with cocci dorsally rounded; seeds 401 ovate, with conical swelling at base, later with sulcate appendage. Fl. second half of May–July, Fr. August–September.

Stony and rocky slopes. — Caucasus: S. Transc. (near Erivan). Gen. distr.: E. Med., As.-Min., Arm.-Kurd., Iran. (N.). Described from hills east of Denizli in Turkey. Type in Geneva.

68. *E. stepposa* Zoz sp. nova in Addenda XIII, 738. — *E. glareosa* var. *elatior* M. B. Fl. taur.-cauc. III (1819) 325. — *E. glareosa* auct.; Boiss. in DC. Prodr. XV, 2 (1862) 165; Fl. or. IV, 1129, p. p. non typ. non M. B. (1808). — *E. pannonica* auct. fl. ucr. non Host. — *Tithymalus stepposus* (Zoz) Prokh. comb. nova, nomen altern. — Exs.: G. R. F. No. 2588 ("E. glareosa").

Perennial plants, (15)20–60(70) cm high, subglabrous, grayish-green; root thick, multicapital; stems fairly numerous, erect or ascending, 2–7 mm thick, rounded, hardly striate, naked at base and with leaf scars, sometimes papillate, glabrous above, more or less densely leafy, without lateral shoots, above with 3–14 axillary peduncles 1.5–8 cm long; cauline leaves sessile, rounded at base, linear-oblong or narrowly oblanceolate or linear-lanceolate or rarely (the upper) elliptic, 2.5–7.5 cm long, 4.5–20 mm wide, (3)4 to 8 times longer than wide (the upper usually $2\frac{1}{2}$ to $3\frac{1}{2}$), obtuse, entire, finely dentate at apex, coriaceous, glabrous, conspicuously 3–5-nerved, the midrib along the entire leaf, the 2 lateral nerves at sharp angle to the median, the others palmately extending from base. Terminal peduncles 7–13, 1–5(7) cm long, like axillary peduncles forked for 1 or 2 times (rarely thrice); leaves of involucre rounded or rarely attenuate at base, lanceolate-elliptic or oblong or rhombic-ovate or obovate, 0.8–4.6 cm long, 5–10 mm wide, slightly but frequently distinctly ($1\frac{1}{2}$ to 3 times) longer than wide, obtuse; leaves of involucels 2, rounded or truncate or hardly cordate at base, orbicular- or triangular-ovate or rarely reniform, obtuse, often short-cuspidate, entire, 1-nerved, sometimes somewhat yellowish, the lower (4)7–17(20) mm long, (6)8–18(21) mm wide, slightly wider than long (usually up to $1\frac{1}{2}$ times and rarely up to twice); cyathium turbinate, 2–2.5 mm long, 1.5–2 mm wide, glabrous, lobes ovate, obtuse, dentate, ciliate; nectaries trapeziform, obtuse-truncate, hornless; styles 2–2.5(3) mm long, connate for $\frac{1}{3}$, deeply bifid; schizocarp ovoid, (2.5)3–4 mm long, (2)2.5–3.5 mm wide, obscurely sulcate, nearly smooth and orbicular at cross section, bordered at base with perianth; seeds compressed-oblong, 2–2.2 mm long, 1.2–1.5 mm wide, smooth, grayish-green, brown-spotted, with small, sessile, obtuse conical appendage. Fl. June, Fr. July.

- 402 Calcareous and chalky slopes in steppes. — European part: M. Dnp., V.-Don (S.), Bes., Crim. (N.), Bl., L. Don; Caucasus: Cisc.? Endemic. Described from Rovenki district in Lugansk Region. Type in Kiev.

69. *E. glareosa* Pall. ex M. B. Fl. taur.-cauc. I (1808) 373, III, 324. — *E. glareosa* var. *minor* Boiss. Fl. or. IV (1879) 1129. — *E. nicaeensis* β . *glareosa* Ldb. Fl. Ross. III (1851) 573. — *E. Maleevi* Tamamsh. in Dokl. Akad. nauk Arm. SSR (1944) 45. — *Tithymalus glareosus* (Pall. ex M. B.) Prokh. comb. nova, nomen altern.

Perennial plants, 6–25(35) cm high, usually slightly velutinous, glaucous; root vertical or obliquely descending; stems numerous, decumbent or ascending at base then more or less erect, woody below, early becoming naked with leaf scars, densely leafy above, sulcate, above with 1–6 axillary peduncles 1–5 cm long, without sterile branches; cauline leaves sessile, tapering and somewhat amplexicaul at base, oblong or oblong-oblanceolate, (1.2)1.5–3.5(4) cm long, 4–12 mm wide, $2\frac{1}{2}$ to 5 times longer than wide, abruptly cuspidate, slightly cartilaginous at margin, finely crenate at apex only, finely ciliate, thick, obscurely 3-nerved. Terminal peduncles 3–7, (0.8)1.5–4 cm long, like axillary peduncles forked for once or twice; leaves of involucre orbicular- or rhombic-ovate or oblong-obovate, 7–20(25) mm long, 5–13 mm wide, slightly or distinctly longer than wide (up to $2\frac{1}{2}$ times), short-cuspidate; leaves of involucels 2, orbicular-triangular or reniform, slightly or distinctly (up to 2 times) wider than long, obtuse, mucronulate,

more or less yellowish, the lower 5–10 mm long, 6–12(15) mm wide; cyathium campanulate, 2–3 mm in diameter, glabrous, hairy inside at throat, with oblong, truncate-emarginate, fimbriate-ciliate lobes; nectaries yellow, trapeziform, truncate, sometimes slightly pectinate outside along outer margin, hornless or hardly bicornute; styles 2–2.5 mm long, half-connate or more, slightly bifid; schizocarp ovoid, 3.5–4 mm long and wide, glabrous, hardly trisulcate, tuberculate-dotted, orbicular, at cross section; seeds ovate (without appendage), 2.5 mm long, 1.5 mm wide, a little compressed, grayish or light chestnut, sparsely pitted, with rounded, orbicular-conical, 2-lobed, stalked appendage. Fl. May–June, Fr. July. (Plate XXI, Figure 3.)

Stony places, pebbles and taluses of sands. — European part: Crim.; Caucasus; E. and S. Transc. Endemic? Described from the Crimea. Type in Leningrad.

403 Note. *E. glareosa* Pall. ex M. B. is distributed in the mountains of the Crimea and E. Transcaucasia. We were unable to find any morphological characteristics distinguishing it from *E. maleevi* described from Transcaucasia.

70. *E. volgensis* Krysh. in Izv. Glavn. Bot. Sada SSSR, XXVIII (1929) 375, and in Fl. Yugo-Vost. V, 667. — *E. glareosa* auct.; Korsh. Tent. Fl. Ross. or. (1898) 375, non M. B. — *Tithymalus volgensis* (Krysh.) Prokh. comb. nova, nomen altern. — *Galarhoeus volgensis* Prokh. in Tr. Kuibys. Bot. Sada, I (1941) 38, olim. — Ic.: Krysh. in Fl. Yugo-Vost. V, 668, tabl. 469.

Perennial plants (3.5)6–22 cm high, completely velutinous (under magnification) with short papilliform hairs, glaucous; root creeping or obliquely descending, thickened under stem, stout, cylindrical, multicapital; stems numerous, sterile and fertile, ascending or flexuous at base, then more or less erect, (2)5–17 cm high, 1–2.5 mm thick, below with scars from fallen squamiform leaves, densely leafy (especially sterile stems) bearing above 1–2 axillary peduncles (1.5–4.5 cm long), sometimes without, sterile branches absent; cauline leaves sessile, long-tapering at base, narrowly oblanceolate or linear-spatulate, 1–4.4 cm long, 3–9 mm wide, acuminate or abruptly short-cuspidate, entire or sometimes denticulate, ciliate at margin, thick, usually parallelly 3-nerved, with weaker lateral nerves. Terminal peduncles 3–6(7), 0.7–4 cm long, like axillary peduncles once or twice bifurcate; leaves of involucre oblong or ovate or obovate, (0.7)1–3 cm long, 3–12 mm wide, short-acuminate or rarely obtuse, with 3–5–7 parallel nerves; leaves of involucels 2, not cordate, orbicular-reniform or rhombic-ovate, abruptly short-cuspidate, generally brighter than the cauline, the lower 5–8(14) mm long, 7–12(19) mm wide; cyathium campanulate, 2–3 mm long, 2–2.5 mm in diameter, glabrous outside, lobes orbicular or oblong-lanceolate, usually emarginate or bi- or tridentate, ciliate; nectaries crescent-shaped, truncate or emarginate at margin, more or less pubescent, hornless or rarely hardly bicornute; styles 1.5–2.5 mm long, half-connate, bifid; schizocarp ovoid-conical, 3–4.5 mm long, 2–3.5(4) mm wide, orbicular-triangular at cross section, hardly trisulcate, glabrous, smooth; seeds compressed-oblong, 2.5–3 mm long, glaucescent-gray or whitish, nearly smooth or hardly dark-pitted, with rather large, suberect, conical, short-stalked appendage. Fl. second half of May – June to first half of July, Fr. July – first half of August.

Stony slopes of lime or chalk, stony steppes, rarely in dry pine forests. — European part: V.-Don (E.), Transv., L. Don (E.). Endemic. Described from the central part of the Volga area. Type in Leningrad.

- 404 71. *E. goldei* Prokh. sp. nova in Addenda XIII, 738. — *Tithymalus Goldei* Prokh. nomen altern.

Perennial plants, 15–27 cm high, grayish-glaucous, more or less yellow above, slightly velutinous-hairy; root descending, cylindrical, 0.5–1.5 cm thick, multicapital above; stems ascending in tufts, 15–20 cm long, rounded, naked in lower part, with sporadic leaf scars, 2–4 mm in diameter, bearing above 1–5 axillary peduncles (2–4.5 cm long), sometimes without, sterile branches always absent; cauline leaves sessile, rounded or slightly tapering at base, oblong or elliptic, 1.8–3.3(4.5) cm long, 6–18 mm wide (usually 2 to 3 times longer than wide), rounded at apex, obtuse, often abruptly more or less cuneate-cuspidate, finely crenate-serrate and narrowly rimmed above along margin, thick, palmately 3–5-nerved, with midrib ending as a mucro. Terminal peduncles 5–8, 1.5–4.5 cm long, like axillary peduncles once or twice bifurcate; leaves of involucre rounded at base, elliptic or orbicular-elliptic or suborbicular, (0.8)1.2–3.2 cm long, (0.6)0.8–2 cm wide, more or less longer than wide (usually $1\frac{1}{2}$ times), obtuse, often cuneate-cuspidate, finely crenate, palmately 3–5-nerved, sometimes somewhat yellowish; leaves of involucels 2, truncate or shallowly cordate at base, suborbicular-reniform, 6–10 mm long, 8–15 mm wide, usually $1\frac{1}{3}$ to $1\frac{1}{2}$ times wider than long, obtuse, appearing finely crenate, with midrib ending as a rostriform mucro (0.5–1 mm long), yellowish, thick; cyathium campanulate, ca. 2 mm long, 2.5–3 mm in diameter, hairy inside, with ovate, obtuse, dentate or notched lobes; nectaries crescent-shaped, outer margin truncate, hornless; styles 2–2.5 mm long, connate for $\frac{1}{3}$, bifid; schizocarp conical-ovoid, 3–4 mm long, 2.5–3.5 mm wide, with orbicular, dotted-tuberculate cocci; seeds compressed-oblong, ca. 2.5 mm long, 1.5 mm wide, smooth, with small brown spots and obtuse conical, slightly inclined appendage. Fl. second half of June – first half of August, Fr. July – first half of August.

Slopes. European part: Crim. (Yaila Mountains). Endemic. Described from the Yaila Mountains in the Crimea. Type in Leningrad.

Subsection 3. MYRSINITEAE Boiss. in DC. Prodr. XV, 2 (1862) 173; Fl. or. IV, 1085, 1134; Maleev in Zhurn. Russk. Bot. Obshch. XV (1930) 47–54. — Murtekias Rafin. Fl. tellur. IV (1838) 116. — Generis *Tithymali* subgen. *Murtekias* Prokh., Obz. moloch. Sr. Azii (1933) 206. — For characteristics of the subsection, see Key on page 248. Type of subsection: *Euphorbia myrsinites* L.

- 405 This is a purely Mediterranean subsection with a typical winter period of development. Growth starts under the hard conditions of the late fall and culminates in blossoming early in the spring. Sterile shoots are developed toward the fall; renewal of growth and the beginning of anthesis take place in the early spring. A certain succulence of the leaves indicates an adaptation to arid conditions. Moreover, as it is so morphologically distinguished by its fruits, seeds and in particular the absence of bracts in the staminate flowers, this subsection could probably be regarded as a separate section.

Series 1. *Biglandulosae* Prokh. — For characteristics of the series see Key on page 248. Type of series: *Euphorbia biglandulosa* Desf.

72. *E. biglandulosa* Desf. in Ann. Mus. Par. XII (1808) 114; Boiss. in DC. Prodr. XV, 2, 175; Fl. or. IV, 1136. — *E. rigida* M. B. Fl. taur.-cauc. I (1808) 375, III, 327; Ldb. Fl. Ross. III, 579. — *Tithymalus biglandulosus* (Desf.) Haw. Syn. pl. succ. (1812) 141. — Ic.: Desf. l. c. tab. 14 et Choix, Pl. Tourn. tab. 67 ("*E. rigida*"); Bot. Reg. IV, tab. 274 et XXIV, tab. 43. — Exs.: G. R. F. No. 1037.

Perennial plants, (20)30–40 cm high, glabrous, glaucous, rarely somewhat reddening; stems erect, 6–10 mm thick, striate-sulcate, densely leafy, without axillary peduncles, all shoots sterile in the winter and partly blossom in the spring; cauline leaves imbricate, sessile, oblanceolate, 2–7 cm long, 7–15 mm wide (the upper smaller), acute, subspinous, fleshy, inconspicuously 3-nerved. Terminal peduncles 7–12, 1–5 cm long, bifurcate at summit; leaves of involucre oblong-obovate or rhombic-ovate, 12–30 mm long, 7–15(21) mm wide; leaves of involucels 2, cordate at base, triangular-reniform, wider than long, obtuse, mucronate, pale yellow, the lower 1.1–1.5 cm long, 1.5–2(2.5) cm wide; cyathium broadly campanulate, 3.5–4.5 mm long, 4.5–5.5 mm in diameter, with ovate (ca. 2.5 mm long, 2 mm wide), pale green, fimbriate-dentate lobes; nectaries transversely oblong, 1.5–2 mm long, with thick, spatulate horns (ca. 1.5 mm long) lobed at apex; styles 3–3.5 mm long, half-connate, 2-lobed; schizocarp rather large, ovoid-triangular, 6–7 mm long, 5–6.5 mm wide, obtuse, turbeculate-dotted, cocci dorsally ribbed; seeds oblong-tetrahedral, 4–4.5 mm long (without appendage), 2–2.5 mm wide, whitish, smooth, with flattened spatulate-folded appendage. Second half of February – March.

Rocky and stony slopes of dry coastal hills. — European part: Crim. (lower zone of the southern slopes); Caucasus: W. Transc. (northwest between Olginka and Nebug). Gen. distr.: W. Med. (Sicily and Calabria), E. Med. (Syria), Bal.-As. Min. (except for northwest and Cyprus). Described from Crete. Type in Paris.

06 73. *E. monostyla* Prokh. sp. nova. — *Tithymalus Marschallianus* auct.; Prokh., Obz. moloch. Sr. Azii (1933) 206. — *E. Marschalliana* auct.; Prokh., ibid. non Boiss. — *Tithymalus monostylus* Prokh. nomen altern. — Ic.: Prokh., l. c. tabl. 69 ("*T. Marschallianus*"). — Exs.: G. R. F. No. 2594 ("*E. Marschalliana*").

Perennial plants, 20–50 cm high, glabrous, glaucous, often reddish in upper part; root thick (1–2 cm), long, multicapital above; stems many, ascending, thick (5–10 mm), slightly tapering below, more or less sulcate, simple, sometimes only above with 2–8 axillary peduncles 2.5–3 cm long, leafless in lower half, with leaf scars (up to 3 mm long), wintering in sterile state, blossoming in second year; cauline leaves alternate, very dense, longer than internodes (by 4 to 5 times and more) from the lower extending to median and then tapering to the upper, sessile, long-cuneate at base (except for the upper), rhombic-oblanceolate, 1.3–4(4.5) cm long, 5–12(15) mm wide, more or less acuminate, narrowly cartilaginous at margin, subentire,

fleshy, inconspicuously veined. Terminal peduncles 10–16(19), 1–2.5 cm long, thick, ribbed-striate, like axillary peduncles once or twice bifurcate; leaves of involucre and upper cauline leaves rhombic-obovate or spatulate-oblong or sometimes suborbicular, 8–15 mm long, 5–10 mm wide, abruptly short-cuspidate, slightly denticulate along the narrowly cartilaginous margin; leaves of involucels 2, sessile, slightly amplexicaul at base, orbicular or orbicular-reniform, concave, obtuse, sometimes mucronulate, subentire, often reddish, the lower 5–10 mm long and wide; cyathium campanulate, 2–3 mm long and broad, lobes large, orbicular or spatulate (1.5–2.5 mm wide), dentate, reddish; nectaries transversely oblong (2–3 mm long), brown, bicornute, with spatulate horns dilated above, as long as width of nectary; styles 1.5–2 mm long, connate for $\frac{3}{4}$, nearly simple, with hardly 2-lobed stigmas; schizocarp trihedral, truncate, 4.5–5.5 mm long, 4–5 mm wide, depressed above, smooth, nearly not sulcate, with obtusely keeled cocci; seeds oblong, 3.5–4 mm long, tetrahedral, nearly smooth, whitish, with erect conical reddish appendage truncate-notched above. Fl. March, Fr. April. (Plate XXI, Figure 6.)

Dry stony or pebbly-clayey slopes and rocky places. — Centr. Asia: Mtn. Turkm. (Kopet Dagh Range and Greater Balkhan). Gen. distr.: Iran. Described from the Dzhebel railway station in Turkmenistan. Type in Leningrad.

Series 2. *Myrsiniteae* Prokh. For characteristics of the series, see Key on page 247. Type of series: *Euphorbia myrsinites* L.

407 Note. Most of the Russian species of the subsection belong to this series.

74. *E. spinidens* Bornm. ex Prokh., Obz. moloch. Sr. Azii (1933) 208. — *Tithymalus spinidens* Prokh. l. c. nomen altern. — Ic.: Prokh. l. c. tabl. 70.

Perennial plants, 30–40 cm high, glabrous, somewhat glaucous; root vertical or obliquely descending; stems not branching at first, later (in the next year) developing below; twice as long branches; fertile stems rather many, more or less erect, up to 35 cm high, 3–7 mm thick, naked in lower part, with leaf scars, generally not branching or only at base, above with 1–4 axillary peduncles (2–2.5 cm long), sometimes absent; leaves of fertile stems sessile, antrorse (except the upper), cuneate at base, spatulate, 2–2.5 cm long, 4–1.2 mm wide, $2\frac{1}{2}$ to $3\frac{1}{2}$ times longer than wide, dilated above, rounded or nearly truncate at apex, slightly cartilaginous at margin, irregularly and acutely toothed (teeth 0.5–1 mm long), mucronate (1–1.5 mm long), entire at sides, obscurely 1-nerved, upper leaves (under peduncles) spatulate-obovate, obtuse, hardly mucronate, entire, leaves on the shorter sterile stems dense, cuneate at base, spatulate-obovate, 1–3.5 cm long, 0.3–1.9 cm wide, acutely dentate at apex, gradually ending in mucro. Terminal peduncles 6–11, 1–3 cm long, like axillary peduncles simple or bifurcate; leaves of involucre orbicular-obovate or oblong, 12–16 mm long, 6–10 mm wide, usually $1\frac{1}{2}$ to 2 times longer than wide, rounded at apex, hardly mucronate, entire or rarely dentate above; leaves of involucels 2, rhombic-reniform or orbicular-triangular, 8–10 mm

long, 9–12 mm wide, slightly wider than long, obtuse, mucronulate, entire; cyathium broadly campanulate, 2.5–3.5 mm in diameter, glabrous outside, with reddish orbicular (1–1.5 mm wide) fimbriate-dentate lobes; nectaries transversely oblong (up to 2 mm in diameter), bicornute, horns narrow, spatulate-linear, white, more or less longer (up to 2 times) than width of nectary; styles 2–2.5 mm long, half-connate, shortly bifid; schizocarp tetrahedral-ovoid, 5–6 mm long, 4–5 mm wide, more or less truncate, smooth, nearly not sulcate, with acutely ribbed cocci; seeds oblong, 3–3.5 mm long, orbicular-tetrahedral, whitish, vermiform-rugose, tuberculate, with conspicuous conical appendage open above. Fr. May–June. (Plate XXI, Figure 7.)

Mountains, ravines and slopes, gorges and rock fissures. — Centr. Asia: Pam.-Al. (Kugitang Range and Baisun-Tag Mountains in the southwest).

108 Gen. distr.: Iran. (Khorasan, Afghanistan?). Described from Kugitang village on Kugitang Range. Type in Leningrad.

75. *E. myrsinites* L. Sp. pl. (1753) 461; M. B. Fl. taur.-cauc. I, 376; Boiss. in DC. Prodr. XV, 2, 173; Fl. or. IV, 1134. — *Tithymalus Myrsinites* (L.) Hill, Hort. Kew. 172/4, nomen altern. — Ic.: Sibth. et Sm. Fl. Graec. V, tab. 471; Rchb. Ic. Fl. Germ. V, tab. 148, f. 4796. — Exs.: Kotschy, pl. exs. 1859, No. 399 ("E. Marschalliana").

Perennial plants, (5)10–25 cm high, glabrous, glaucous, more or less reddish; stems ascending or decumbent, up to 40 cm long, 2–5 mm thick, striate-sulcate, densely leafy, without axillary peduncles, wintering as sterile shoots, part of which blossom in early spring; cauline leaves of two kinds: winter leaves (on sterile shoots and at base of fertile), rather large, rhombic-obovate or suborbicular, 2–3.5 cm long, 0.9–2.8 cm wide, and spring leaves (at upper parts of fertile stems), oblong-obovate, 1–2 cm long, 0.6–1 cm wide, both kinds sessile, obtuse, abruptly and shortly hamate-cuspidate, cartilaginous at margin, denticulate above, obscurely 3-nerved. Terminal peduncles (6)7–10, 0.5–4 cm long, 1–1.5 mm thick, striate-sulcate, forked for 2(3) times; leaves of involucre oblong-obovate or suborbicular, 1–2.8 cm long, 0.7–2 cm wide; leaves of involucels 2, more or less cordate at base, reniform, wider than long, obtuse, mucronulate, often yellowish, the lower 0.7–1.3 cm long, 1–1.7 cm wide, the terminal smaller; cyathium campanulate-subglobular, ca. 3 mm long, 4 mm in diameter, with large orbicular (1.8–2.2 mm in diameter) fimbriate reddish lobes; nectaries transversely oblong, 2–3 mm long, with horns as long as width of nectary, dilated and hardly lobed at apex; styles 1.5–2 mm long, half-connate, 2-lobed; schizocarp ovoid-tetrahedral, 5.5–7.5 mm long, 5–6.5 mm wide, smooth, with keeled cocci; seeds oblong, obscurely tetrahedral, 2.5–3 mm long (without appendage), 1.6–1.7 mm wide, grayish, densely vermiform-sulcate, with stalked flattened-conical appendage notched at summit. April (again in June). (Plate XXI, Figure 5.)

Rocky and stony calcareous slopes. — European part: Crim. Gen. distr.: W. Med. (Italy), Bal.-As. Min. (Cyprus). Described from Calabria in S. Italy and from near Montpellier in the south of France. Type in London.

76. *E. pontica* Prokh. sp. nova in Addenda XIII, 740. — *Tithymalus ponticus* Prokh. nomen altern. — *E. pectinata* auct. fl. cauc. non Alboff (1894). — Exs.: Herb. Fl. Cauc. No. 484 ("Tithymalus pectinatus").

- 409 Perennial plants, 15–35 cm high, glabrous, dark grayish-green to more or less reddish; root long, descending, multicapital above; stems rather numerous, ascending, sterile and fertile 3–5 mm thick, tapering at base, simple, sometimes with single axillary peduncle above; cauline leaves dense, oblanceolate or rarely rhombic-obovate, (1.2)1.4–2.5(3.6) cm long, 0.6–1.2(1.7) cm wide, 2 to 3 times longer than wide, cuspidate, slightly involute at margin, subentire, fleshy, obscurely veined. Terminal peduncles 5–12, 1–2(4) cm long, simple or forked once or twice; leaves of involucre sessile, orbicular or rhombic-obovate or oblong, 0.9–1.6(2.7) cm long, 0.5–1.4(1.6) cm wide, more or less longer (up to 2 times) than wide, abruptly short-cuspidate, entire; leaves of involucels sessile, more or less rounded at base, the lower orbicular or rhombic-reniform, 4–6(10) mm long, (5)6–14(15) mm wide, obtuse, rarely hardly cuspidate, entire, often reddish, the upper reduced, suborbicular, obtuse, especially red in fruit; cyathium campanulate, 3–3.5 mm in diameter, with orbicular (1–1.2 mm wide) whitish crenate lobes; nectaries crescent-shaped, bicornute, horns spatulate, usually not longer than width of nectary; styles 1.5–2 mm long, half-conate, subentire, with hardly elongate stigmas; schizocarp trihedral-ovoid, 4.5–5.5 mm long, 4–5 mm wide, truncate above, trisulcate, with obtusely keeled cocci; seeds whitish, oblong 2.8–3 mm long (without appendage), orbicular-tetrahedral, vermiform-rugose, with erect truncate-conical short-stalked appendage notched above. Fl. April, Fr. May. (Plate XXI, Figure 2.)

Stony slopes. — Caucasus: W. Transc. (S.). Gen. distr.: As. Min. (near Artvin in northeast). Described from Bartsokhet Mountain near Ardanuch in Artvin District. Type in Leningrad.

77. *E. woronowii* Grossh. in Tr. Tifl. Bot. Sada, XIV (1916) 24, em. Prokh.

- 410 Perennial glabrous plants, sometimes scabrous on peduncles, glaucous; root sometimes creeping, thin (5–10 mm), multicapital above; stems rather numerous, ascending, 10–20(30) cm high, slightly striate, 4–6 mm thick, tapering at base, without sterile lateral shoots, without or with 2–3 axillary peduncles (2–5 cm long) above, densely leafy; cauline leaves sessile, more or less cuneate at base, rhombic-obovate or rhombic-oblanceolate, 8–20(27) mm long, 3–10(16) mm wide, usually 2–3 times longer than wide (leaves on sterile stems often only $1\frac{1}{2}$ times), acuminate or cuspidate, cartilaginous at margin, finely but distinctly bristly-crenate, fleshy, inconspicuously veined. Terminal peduncles 9–20, 2–4 cm long, like axillary peduncles once or twice bifurcate; leaves of involucre oblong or oblong-spatulate or oblong-obovate, 10–17 mm long, 4–10 mm wide, usually $1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide, short-cuspidate, finely bristly-crenate; lower leaves of involucels not cordate at base, obtuse, short-cuspidate, crenulate, the upper orbicular-triangular or suborbicular or oblong, 6–10 mm long, 5–15 mm wide, as long as wide or $1\frac{1}{2}$ times longer than wide or wider than long, the terminal reduced, orbicular or orbicular-rhombic; cyathium campanulate, 2.5–3.5 mm in diameter, with orbicular reddish crenate lobes

(up to 2 mm wide); nectaries reddish, transversely oblong (ca. 2 mm long), bicornute, with white spatulate horns a little longer than nectaries; styles 2.5–3 mm long, half connate, 2-lobed; schizocarp ovoid, trihedral, 5–6 mm long, slightly obtuse, smooth, faintly trisulcate, with acutely ribbed cocci; seeds whitish, sometimes greenish, oblong, 2.8–3.2 mm long (without appendage), rugulose or often nearly smooth, with large (1–2 mm long) conical-ovate acute stalked appendage. Fl. April, Fr. second half of April–May.

Dry stony slopes. — Caucasus: S. Transc. (Araks River valley). Gen. distr.: Iran. (N.). Described from Erivan District. Type in Tbilisi.

Note. Closely related to *E. marschalliana* Boiss. from which it differs only by a complex of small, transitional, quantitative characters and not by the rugose seeds, as the author reported.

78. *E. marschalliana* Boiss. Diagn. ser. 1, VII (1846) 94 (excl. synonym. *E. Myrsinites* auct. M. B.); Ldb. Fl. Ross. III, 579, p. p. (excl. synonym. *E. Myrsinites* et specimina ex Tauria); Boiss. in DC. Prodr. XV, 2, 175; Fl. or. IV, 1135, p. p. non auct. fl. As. med. — *Tithymalus Marschallianus* (Boiss.) Kl. et Gke. ex Klotzsch in Abh. Akad. 1859 (1860) 86, nomen altern. —

Perennial low plants, glabrous, glaucescent; root thin (5–8 mm), multicapital above; stems fairly numerous, fertile and sterile, ascending, 10–20(25) cm long, 2–4 mm thick, simple, rarely with 1 axillary peduncle above, naked in lower part, with leaf scars, densely leafy above (internodes 6–10 times shorter than leaves); cauline leaves sessile, more or less cuneate at base, oblong-spatulate or (especially on sterile shoots) rhombic-obovate, 10–25 mm long, 5–12(14) mm wide, $1\frac{1}{2}$ to $2\frac{1}{2}$ times longer than wide, more or less acuminate or cuspidate, often finely crenate and bristly at the narrowly cartilaginous margin, fleshy, inconspicuously veined.

411 Terminal peduncles 7–12, 1–2.5 cm long, simple or bifurcate at summit; leaves of involucre sessile, orbicular or orbicular-obovate, 8–15 mm long, 6–11 mm wide, as long as wide to more or less longer (up to $1\frac{1}{2}$ times), abruptly short-cuspidate, partly finely bristly-dentate; leaves of involucre 2, slightly cordate at base, orbicular or rhombic or triangular-reniform (the lower 5–8 mm long, 6–11 mm wide), more or less wider (up to $1\frac{1}{2}$ times) than long, often abruptly short-cuspidate, crenulate; cyathium campanulate, 3–3.5 mm in diameter, lobes large, often reddish, orbicular-ovate (ca. 1 mm wide), obtuse, denticulate; nectaries transversely oblong (ca. 1.5 mm long), bicornute, with white spatulate horns, as long as width of nectary; styles 2.5–3 mm long, half-connate, shortly 2-lobed; schizocarp ovoid trihedral, 5–6 mm long, 4–5 mm wide, sometimes obtuse, smooth, slightly trisulcate, with acutely ribbed cocci; seeds white, oblong 2.8–3 mm long (without appendage), rugulose or nearly smooth, with large conical-ovate (ca. 1 mm long) acute stalked appendage, sometimes later open above. Fl. April, Fr. May–June. (Plate XXI, Figure 1.)

Dry stony and pebbly slopes. — Caucasus? S. Transc. (near Migra), Tal. Endemic? Described from the vicinity of Zuvant in Talysh. Type in Geneva.

Note. The epithet of this species was given by Boissier, who at first erroneously had identified it with the Crimean *E. myrsinites* of

Marschall Bieberstein. Boissier himself admitted later that it should not be referred to *E. myrsinites* L. and represented the authentic material of the latter. In conformity with the rules of botanical nomenclature the name must be preserved.

79. *E. armena* Prokh. sp. nova in Addenda XIII, 741.— *Tithymalus armenus* Prokh. nomen altern.

412 Perennial low glabrous glaucous plants; root branching, multicapital, above; stems fairly numerous, fertile and sterile, ascending, (10)15–25(30) mm long, 4–5 mm thick, more or less branching at base into lateral shoots, simple above, but without or with 1–3 axillary peduncles (2.5–4.5 cm long), densely leafy, naked below, with leaf scars; cauline leaves sessile, cuneate at base, rhombic-obovate or rarely spatulate-oblong, 12–28(35) mm long, 6–16(20) mm wide, usually 1.5 to 2 times longer than wide, abruptly cuspidate, narrowly cartilaginous at margin, inconspicuously crenulate-serrate, fleshy, obsolete veined. Terminal peduncles (4)5–7, (1.5)2–5 cm long, like axillary peduncles forked for 1–2 times; leaves of involucre orbicular or rhombic-ovate, 9–18 mm long, 8–19 mm wide, about as long as wide or rarely up to $1\frac{1}{2}$ times longer, obtuse, sometimes abruptly cuspidate, narrowly cartilaginous at margin, usually subentire; leaves of involucels 2, more or less deeply cordate at base, reniform or triangular-reniform, (5)8–15 mm long, (7)11–21 mm wide, slightly to usually $1\frac{1}{2}$ times wider than long, obtuse, sometimes abruptly somewhat cuspidate, subentire; cyathium campanulate, 3–3.5 mm in diameter, with large (1.5–2 mm) reddish orbicular crenate lobes; nectaries transversely oblong (2–3 mm across), bicornute, with whitish spatulate horns, hardly as long as width of nectary; styles 2–2.5 mm long, half-connate, 2-lobed; schizocarp trihedral-ovoid, 5–6 mm long, 4.5–5.5 mm wide, somewhat obtuse, smooth, faintly sulcate, with acutely ribbed cocci; seeds whitish, oblong-tetrahedral, ca. 3 mm long, nearly smooth or hardly rugose, appendage large (ca. 1.5 mm long), conical-ovate, acute, longitudinally plicate, stalked. Fl. April–May, Fr. May–June.

Dry stony steppe and stony slopes.—Caucasus: S. Transc. (vicinity of Erivan and also near Atskhur and Borzhomi). Endemic. Described from Echmiadzin near Erivan. Type in Leningrad.

Series 3. *Denticulatae* Prokh.—For characteristics of the series see page 248 of the Key. Type of series: *Euphorbia denticulata* Lam.

Note. *E. craspedia* Boiss. also belongs to this series.

80. *E. denticulata* Lam. Dict. Bot. II (1786) 435; Boiss. in DC. Prodr. XV, 2 (1862) 174; Fl. or. IV, 1135.—*E. cilicica* Boiss. Diagn. ser. 2, IV (1844) 88.—*E. pectinata* Alboff in Bull. Herb. Boiss. II (1894) 64.—*Tithymalus denticulatus* (Lam.) Moench, Meth. (1794) 668, nomen altern.—Ic.: Boiss. Ic. Euph. tab. 119; Post, Fl. Syriae, Palest. Sinai, 725; Beguinot et Diratz. Contr. Fl. Armen. 72.

Perennial glabrous plants, 18–25 cm high; root long, thick (1–1.5 cm), multicapital above; stems fairly numerous, fertile and sterile, ascending, relatively thick (3–8 mm), woody at base, simple, only sometimes with 1 axillary peduncle above; cauline leaves dense-imbricate, the lower 3 to 4 times longer than internodes, sessile, slightly cordate at base, rhombic-obovate or rarely oblong, 1.2–3 cm long, 0.8–2.7 cm wide, obtuse, then abruptly cuspidate, narrowly cartilaginous at margin, crenulate. Terminal peduncles 5, 2–4 cm long, once or twice bifurcate; leaves of involucre and often upper cauline leaves orbicular-obovate or orbicular, 1.2–2.7(3.5) cm long, 1.2–2.3(3) cm wide, obtuse; leaves of involucels obtuse, slightly
 413 concave, the lower rhombic-reniform, 0.6–1.6(2) cm long, 0.8–2.2(2.5) cm wide, the upper smaller, orbicular-ovate; cyathium subglobular, ca. 5 mm in diameter, with wide (1.5 mm) ovate reddish ciliate lobes; nectaries purple, transversely oblong (3.5 × 2 mm), truncate at outer margin, shortly pectinate-multidentate; styles ca. 2 mm long, half-connate, deeply bifid; schizocarp large, trihedral, ca. 9 mm long, 7 mm wide, truncate at base, faintly trisulcate, with acutely keeled cocci; seeds oblong-orbicular, tetrahedral because of projected netted wrinkles, vermiform-plicate [?], with flattened conical pitted appendage. Fl. second half of April–first half of May, Fr. May.

Stony slopes and taluses in mountains up to the subalpine belt. — Caucasus: possibly found in W. Transc. (collected in the vicinity of Kagyzman in Kars District). Gen. distr.: E. Med., As. Min., Arm.-Kurd. Described from Asia Minor. Type in Paris.

Note. *E. pectinata* Alboff, understood incorrectly by authors of Caucasian flora, is undoubtedly referred to here (see Woronow, Herb. fl. cauc. No. 484). Since this particular species was gathered near Kagyzman in Kars District, it is quite possible that it would be found one day in the USSR. *E. pectinata* was described from near Artvin. Since it is rare whereas another spurge is common there, it is not surprising that the latter was erroneously accepted as *E. pectinata* Alboff.

Section 6. *ESULA* Prokh.* sect. comb. nova. — Generis *Tithymali* sect. *Esula* Prokh., Obz. moloch. Sr. Azii (1933) 166, ampl. — For characteristics of the section see page 322 of the Key. Type of section: *Euphorbia esula* L.

Note. Like section *Tulocarpa*, this section includes representatives with both yellowish and purple terminal leaves.

Subsection 1. *ESULAE* Prokh. subsect. nova. — Generis *Tithymali* sect. *Esula* Prokh. l. c. — For characteristics of the subsection see page 250 of the Key. Type of subsection: *Euphorbia esula* L.

Series 1. *Andrachnoides* Prokh. — For characteristics of the series see page 250 of the Key. Type of series: *Euphorbia andrachnoides* Schrenk.

* Unfortunately, this section has not been completed, unlike the other sections.

81. *E. buschiana* Grossh. in Bot. Zhurn. SSSR, XXV (1940) 330. — Ic.: Grossg., l. c. tabl. I.

Perennial glabrous pale green plants; root thin; stems numerous, more or less prostrate or ascending, 15–20 cm long, thin, in the lower part simple, naked, with leaf scars, sparsely leafy and branching above, 414 bearing many elongated inflorescences, and densely leafy sterile branches, sometimes with 1–3 axillary peduncles; lower leaves squamiform, triangular-ovate, brown; cauline leaves rounded or slightly cordate at base, orbicular-ovate or sometimes oblong, 8–11 mm long, widest below (8 mm), obtuse or truncate, cartilaginous at margin, crenulate or subentire, with a midrib and weakly developed lateral nerves, leaves on sterile branches short-petiolate, somewhat rounded and abruptly attenuate at base, obovate or spatulate-cuneate or oblong, 5–11 mm long, widest above (3–6 mm), obtuse or truncate, slightly emarginate, sometimes with hardly distinct mucro. Terminal peduncles 3–5, 1.3–4 cm long, like axillary peduncles simple or forked summit; leaves of involucre similar to upper leaves of main stem; leaves of involucels 2, broadly ovate-rhombic, obtuse, the lower 5–9 mm long, 7–11 mm wide; cyathium campanulate, ca. 2 mm long, ca. 1.5 mm in diameter, glabrous, with small ovate obtuse glabrous lobes; nectaries dark, crescent-shaped, bicornute, with short horns; styles ca. 1.5 mm long, nearly half-connate, bifid. Fruit and seeds unknown. July–August.

Rocks and taluses in the alpine belt at altitude of 2,300–2,700 m. — Caucasus: Cisc. (Kulan glacier, along Sukan River, Mekhtygen Mountain). Endemic. Described from the upper reaches of Sukan River in Balkar at the natural boundary of Sukan-Bashi-Tsifi, at altitude of 2,400 m. Type in Leningrad.

Note. Grossgeim related the given species to the *Asia Minor E. herniarifolia* Boiss.

82. *E. undulata* M. B. Fl. taur.-cauc. I (1808) 371, III, 323; Ldb. Fl. Ross. II, 572; Boiss. in DC. Prodr. XV, 2, 159; Korsh. Tent. Fl. Ross. or. 376; Krisht. in Fl. Yugo-Vost. V, 672. — *Tithymalus undulatus* (M. B.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 92, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 170. — *Calarrhoeus undulatus* Prokh. in Tr. Kuibyshevsk. Bot. Sada, I (1941) 43, olim. — Ic.: Boiss. Ic. Euph. tab. 106; Prokh., Obz. moloch. tabl. 57.

Perennial plants, 5–15 cm high, glabrous, yellowish glaucous, sometimes more or less reddish; root thin, creeping; stems usually numerous, sterile and fertile, 3.5–13 cm high, 1–2.5 mm thick, branching at base, branchless above, only usually with (1)2–4(5) axillary peduncles (1–3.5 cm long) above; basal leaves squamiform, brown; cauline leaves short-petiolate, somewhat 417 cordate or broadly cuneate at base, oblong or oblong-elliptic or (especially the lower) orbicular-ovate, 7–26 mm long, 3–13 mm wide, spatulate-truncate at apex or irregularly notched, sometimes with mucro in notch, rarely rounded, cartilaginous at margin, distinctly undulate, rather thick, with 1 nerve, leaves on sterile shoots narrower. Inflorescence comparatively small, corymbiform; terminal peduncles 2–3 (rarely 4 or 5), inconspicuous (0.5–2.5 cm long), like axillary peduncles simple or often forked at summit; leaves of involucre oblong or ovate-oblong, 6–20 mm long,



PLATE XXI. 1 - *Euphorbia marschalliana* Boiss.; 2 - *E. pontica* Prokh.; 3 - *E. glareosa* Pall.; 4 - *E. petrophila* C. A. M.; 5 - *E. myrsinities* L.; 6 - *E. monostyla* Prokh.; 7 - *E. spinidens* Bornm.

2–10 mm wide, truncate or notched or rarely rounded at apex, more or less undulate-dentate; leaves of involucre 2, rounded or broadly cordate at base, orbicular-rhombic or oblong-ovate, 4–10 mm long, 3–8(12) mm wide, obtuse, entire or sometimes slightly undulate at margin; cyathium broadly campanulate, 1.5–2 mm in diameter, glabrous outside, lobes ovate, obtuse or emarginate, reddish, more or less ciliate; nectaries 4, yellowish, crescent-shaped, truncate or notched or crenulate outside, hornless or indistinctly bicornute with short obtuse horns; ovary reddish; styles 1–1.5 mm long, half-connate, hardly 2-lobed; schizocarp ovoid, truncate, 3–4 mm long, 4–5 mm wide, trisulcate, with nearly smooth orbicular cocci, more or less dark colored; seeds ovate, 2–3 mm long, smooth, whitish, with small convex disciform appendage. Second half of April–May.

Semideserts and dry steppes (*Stipa* L. and *Artemisia* L.) on clayey and sandy soils. — European part: L. Don (east, only along Volga), L. V., Transv. (S.); W. Siberia: U. Tob (SW); Centr. Asia: Ar.-Casp. (west, Ural River valley). Endemic. Described from the steppe between Stalingrad ("Tsaritsyn") and Astrakhan in the Volga area.

83. *E. irgisensis* Litw. in Spisok rast. G. R. F. VIII (1922) 102. — *Tithymalus irgisensis* (Litw.) Prokh., Obz. moloch. Sr. Azii (1933) 168. — Ic.: Prokh. l. c. tabl. 56. — Exs.: G. R. F. No. 2589.

Perennial plants, pubescent glaucous-green; root long, cylindrical, almost vertical; stems numerous, erect, 5–26 cm high, branching, with few axillary peduncles above and with sterile branches below them; basal leaves squamiform, brown; cauline leaves sparse, alternate, hardly cordate and slightly amplexicaul or rarely somewhat cuneate at base, broadly ovate or oblong-lanceolate or obovate, 8–21 mm long, 5–15 mm wide, obtuse, often emarginate, sometimes mucronulate, entire, flat, pubescent (especially beneath), leaves on sterile branches narrower and longer, cuneate at base. 418 Terminal peduncles 4–5, like axillary peduncles once or twice bifurcate; leaves of involucre obovate or elliptic or ovate-lanceolate, similar to the cauline in size and shape, sometimes slightly larger; leaves of involucels rhombic-ovate or orbicular-reniform or suborbicular; cyathium broadly campanulate, 3–3.5 mm in diameter, with orbicular denticulate hairy lobes; nectaries crescent-shaped, often pectinate, bicornute or rarely nearly hornless; styles ca. 1.5 mm long, connate below, 2-lobed; schizocarp ovoid, truncate, 4–5 mm long, trisulcate, smooth; seeds ovate, ca. 3 mm long, smooth, with appendage.

Clayey steppes, usually wormwood-hawthorn. — Centr. Asia: Ar.-Casp. Endemic. Described from Irgiz District near Kara-Chokat railway station. Type in Leningrad.

84. *E. andrachnoides* Schrenk. in Bull. Phys.-Math. Acad. Petersb. II (1844) 197; Ldb. Fl. Ross. III, 577. — *Tithymalus andrachnoides* (Schrenk) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 88, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 181. — Ic.: Prokh. l. c. tabl. 62.

Perennial plants, 10–20 cm high, pubescent or rarely glabrous, glaucous; root creeping or obliquely descending; stems few or rarely numerous, sterile and fertile, erect, sometimes flexuous, fertile stems bearing axillary

peduncles above and sterile branches below, sterile stems simple, sometimes exceeding inflorescence; basal leaves squamiform, brown; cauline leaves sessile, deeply cordate and amplexicaul or rarely hardly cuneate at base, ovate-triangular or oblong-ovate, 7–22 mm long, 3–10 mm wide, widest near base, obtuse, entire, coriaceous, leaves on sterile shoots triangular-lanceolate. Terminal peduncles 7–10, like axillary peduncles bifurcate at summit; leaves of involucre oblong-ovate or elliptic, 5–10 mm long, 2–6 mm wide, obtuse, sometimes short-cuspidate; leaves of involucels 2, cordate at base, ovate-triangular or rarely orbicular-ovate, 4–7 mm long, 5–9 mm wide, acute; cyathium campanulate, ca. 3 mm wide, glabrous outside, with orbicular, short-ciliate lobes; nectaries dark brown, crescent-shaped, bicornute, with short acute horns; styles 1–1.5 mm long, half-connate, dilated at apex, shortly bifid; schizocarp ovoid, truncate, 4–5 mm long, trisulcate, with orbicular scabrous-rugose cocci, more or less dark, glabrous or ciliate; seeds ovate, 2–2.5 mm long, smooth, brown, with dark obtuse conical sessile appendage.

119 Riverbanks and foot of slopes. — W. Siberia: Irt. (W.); Centr. Asia: Balkh. (W.). Endemic. Described from Ulu-Tau Mountain (Kazakhstan). Type in Leningrad.

85. *E. buhsei* Boiss. in DC. Prodr. XV, 2 (1862) 167; Fl. or. IV, 1124. — *E. kopetdaghensis* E. Kor. (nomen) in schedis. — *Tithymalus Buhsei* (Boiss.) Prokh., Obz. moloch. Sr. Azii (1933) 166, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 110; Prokh. l. c. tabl. 55.

Perennial plants; stems 25–80 cm high, brown-gray, woody below, with numerous sterile and fertile branches along entire length; basal leaves squamiform, triangular-lanceolate, brownish, deciduous; cauline leaves few, alternate, sessile, rounded or slightly cordate at base, ovate or ovate-lanceolate, 7–18 mm long, 3–8 mm wide, obtuse, rarely hardly cuspidate, entire, glaucous-gray, pubescent or glabrous, with 1 nerve, often deciduous, leaves on sterile branches hardly petiolate, cuneate at base, linear-spatulate, obtuse or truncate. Cymose umbels numerous, at ends of tertiary or quaternary branches of the third or fourth order; terminal peduncles 5–8, straight, or slightly arcuate, 1–7 cm long, pubescent or glabrous, with 2 secondary peduncles at summit, sometimes only with one, sometimes solitary cyathia ending branches instead of cymose umbels; leaves of involucre varying in shape, linear-elliptic to rhombic-ovate, 10–17 mm long, 3–8 mm wide, usually obtuse; leaves of involucels orbicular or rhombic-cuneate or transversely oblong, 6–10 mm long, 6–13 mm wide, obtuse or cuspidate; cyathium campanulate, 3–4 mm in diameter, more or less pubescent, with ovate obtuse densely pubescent (especially at margin) lobes; nectaries crescent-shaped, truncate or notched outside, shortly bicornute with obtuse or rarely acute horns; styles 2–3 mm long, nearly half-connate, bifid; schizocarp ovoid, truncate, 3–4 mm long, trisulcate, cocci smooth, densely pubescent or glabrous, orbicular, gradually darkening; seeds globular, 2–3 mm long, smooth, whitish, with sessile flattened conical appendage.

Stony and clayey mountain slopes. — Centr. Asia: Pam.-Al. (Kugitang Range, red sandstone), Mtn. Turkm. Gen. distr.: Iran. Described from Rishma in E. Iran. Type in Geneva.

Series 2. *Esulae* Prokh. — For characteristics of the series see page 251 of Key. Type of series: *Euphorbia esula* L.

86. *E. esula* L. Sp. pl. (1753) 461; M. B. Fl. taur.-cauc. I, 374, III, 325; Ldb. Fl. Ross. III, 575; Boiss. in DC. Prodr. XV, 2, 160; Fl. or. IV, 1125; Hegi, III, Fl. V, 1, 170. — *E. tristis* Bess. [Catal. hort. cremen. (1811) suppl. 4, 27, et catal. (1816) 57] ex. M. B. Fl. taur.-cauc. III (1819) 326; Ldb. l. c. 574. — *Tithymalus Esula* (L.) Scop. Fl. carn. ed. 2, I (1772) 388, nomen altern. — Ic.: Fl. Danica 420 tab. 1270; Rchb. Ic. Fl. Germ. V, tab. 146, f. 4791; Fl. batava, IX, tab. 703; Hegi, III, Fl. V, 1, f. 1779. — Exs.: Fl. stiriaca exs. Nos. 1012, 1013; Herb. Norm. No. 4297; Fl. Ital. exs. No. 1328; Fl. exs. Boh.-Slov. No. 1009.

Perennial glaucescent plants, 30–80 cm high; root creeping, thin, cylindrical, branching, with long suckers; stems erect, rounded-striate, glabrous, bearing above 1–23 thin often curved axillary peduncles 1.5–7.5 cm long, below with densely leafy, later elongating sterile branches; basal leaves dry-scarious, squamiform; cauline leaves sessile or hardly petiolate, gradually tapering at base, narrowly oblanceolate, 2–7 cm long, 2–8(13) mm wide (usually 7 to 12 times longer than wide), widest in upper third, obtuse, often short-mucronate from the hardly protruding midrib, entire, sometimes densely undulate at the slightly incurved margin, often crenate at apex, soft, later rigid, glabrous, dull green above, blue beneath, lower leaves spreading or even recurved, often short-petiolate, upper leaves antrorse, leaves on sterile branches 7–20 mm long, 2–2.5 mm wide. Terminal peduncles (6)8–13(14), 1.5–6 cm long, like axillary peduncles simple or once or twice forked; leaves of involucre linear-lanceolate or oblong-ovate, only rarely completely similar to the cauline leaves, 1–3 cm long, 1.5–3.5 mm wide (3 to 9 times longer than wide), acuminate; leaves of involucels 2, truncate or broadly cordate at base, rhombic-ovate or triangular-reniform (usually $1\frac{1}{2}$ times wider than long, rarely more than twice), the lower 5–9 mm long, 8–17 mm wide, short-acuminate; cyathium campanulate, 2–2.5 mm long and broad, with short truncate fimbriate lobes; nectaries yellow or green, later becoming brown, shortly bicornute, often nearly hornless; styles 1–1.5 mm long, connate only at base, bifid; schizocarp ovoid, 2.5–3.5 mm long, 2.8–3.8 mm wide, deeply trisulcate, glabrous, cocci orbicular, tuberculate, dorsally rugulose; seeds ovate, ca. 2 mm long, 1.8 mm wide, smooth, yellow-brown, with yellow reniform sessile appendage. June–August.

Meadows, ditches, rivers, shrubby formations, fields and plough-land, roadsides, along railroads, especially on loamy soil. — European part: Balt., U. Dnp., M. Dnp., U. Dns., Bes., Bl. Gen. distr.: Scand. (S.), Centr. and Atl. Eur., W. Med. (N.), introduced into Jap.-Ch. (Tsingtao), N. Am. Described from W. Europe (Germany, Belgium, France). Type in London.

87. *E. microcarpa* Prokh., Obz. moloch. Sr. Azii (1933) 171; Kryl., 421 Fl. Zap. Sib. VIII, 1878. — *E. leptocaula* auct.; Kryl., Fl. Alt. 1194, non Boiss. (1862). — *E. esula* β . *gracilis* Kryl. l. c. 1193. — *Tithymalus microcarpus* Prokh. l. c. nomen altern. — Ic.: Prokh., l. c. tabl. 58.

Perennial plants, glabrous or slightly pubescent, glaucous; root thin, creeping; stems few, more or less erect, 15–80 cm high, bearing above short axillary peduncles, simple below; cauline leaves petiolate, cuneate at base, linear-spatulate or elliptic-linear or linear-filiform, 7–35(50) mm long, 0.1–7 mm wide, obtuse or hardly cuspidate (the upper sometimes acute), often (especially above) falcate, cartilaginous at margin, hardly crenate or subentire, 1-nerved. Terminal peduncles 4–12, like axillary peduncles simple or bifurcate at summit; leaves of involucre sessile, narrowly linear-elliptic, 4–20 mm long, 0.5–3.5 mm wide, short-cuspidate or obtuse; leaves of involucels 2, triangular-ovate or subreniform, 3–10 mm long, 4–15 mm wide, usually acuminate, sometimes overlapping at base; cyathium campanulate, 1.5–2 mm in diameter, with oblong fimbriate lobes; nectaries dark, crescent-shaped, bicornute, with horns generally as long as width of nectary; styles 1–1.5 mm long, connate at base, slightly lobed; schizocarp turnip-shaped, 2.5–3 mm long, deeply trisulcate, cocci smooth, slightly tuberculate dorsally; seeds ovate, 1.5–2 mm long, smooth, grayish-brown, with flattened sessile appendage. May – first half of June.

Moist and especially inundated meadows. — W. Siberia: Irt., Alt. (S.); Centr. Asia: Balkh. (N.). Endemic? Described from the shores of Taldy River in Karkaralinsk District. Type in Leningrad.

88. *E. subtilis* Prokh. in Tr. Kuibyshevsk. Bot. Sada, I (1941) 48. — *E. gracilis* auct.; M. B. Fl. taur.-cauc. III (1819) 324; Ldb. Fl. Ross. III, 574; Krisht. in Fl. Yugo-Vost. V, 671, non Loiseleur (1806). — *E. Esula* L. Sp. pl. (1753) 461, p. p. non typ.; Ldb. l. c.; Boiss. in DC. Prodr. XV, 2, 160. — *Tithymalus subtilis* Prokh. comb. nova, nomen altern. — *Galarhoeus subtilis* Prokh. l. c. olim. — Exs.: ("E. leptocaula") G. R. F. Nos. 2586, 2586b.

Perennial plants, 16–65 cm high, glabrous, grayish-glaucous; root usually cordlike, creeping; stems solitary or few, erect, 14–63 cm high, below 0.5–2 mm in diameter, with or without 1–11 axillary peduncles above, 1.2–5(8) cm long, sterile branches usually absent; cauline leaves short-petiolate or subsessile, more or less cuneate at base, spatulate-linear or narrowly oblanceolate or oblong-oblanceolate, (9)15–45 mm long, 1.5–9 mm wide, obtuse or abruptly short-cuspidate or acute, cartilaginous at margin and slightly incurved, dentate only at apex or entire, 1-nerved. Terminal peduncles 3–8, 1–4(6.5) cm long, like axillary peduncles forked for 1–2 times, rarely simple; leaves of involucre 2–5 times (rarely less than twice) shorter than adjacent peduncles, short-cuneate or rounded but not dilated at base, linear-oblong or lanceolate or ovate or rarely rhombic-ovate, 4–15(28) mm long, 1.5–5(8) mm wide, obtuse or acute; leaves of involucels reniform or transversely elliptic, 4–10 mm long, 6–15 mm wide, obtuse or more or less cuspidate, at first overlapping at base, later only touching or remote from each other; cyathium campanulate, 1–2 mm in diameter, glabrous outside, with small orbicular pubescent lobes; nectaries crescent-shaped, usually shortly bicornute, with horns almost as long as width of nectary; styles 0.7–1.5 mm long, connate at base, bifid; schizocarp turnip-shaped, 2.5–3 mm long, 3–3.5(4) mm wide, deeply trisulcate, cocci orbicular, slightly rugose-tuberculate at back, glabrous; seeds ovate, 1.8–2.2 mm long, brown, smooth, with inflated disciform appendage. Fl. June – first half of July, Fr. first half of June–July.

Steppes, ravines, shrubby formations, bright oak stands, chalk slopes. — European part: M. Dnp., V.-Don (except for the east), Bl., L. Don, U. Dns.; W. Siberia: U. Tob (doubtful in the west). Endemic? Described from Zaleshchiki in S. Bukovina. Type in Leningrad.

89. *E. gmelini* Steud. Nomencl. ed. 1 (1840) 612; Kryl., Fl. Zap. Sib. VII, 1877. — *E. desertorum* Weinm. in Bull. Soc. Nat. Mosc. X (1837) No. 7, 73; Ldb. Fl. Ross. III, 578, p. p. nomen confusum? — *E. rossica* P. Smirn. in Fedde Repert. XXVI (1929) 233. — *Tithymalus Gmelini* Prokh., Obz. moloch. Sr. Azii (1933) 174, nomen altern. — *Galarhoeus Gmelini* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 50, olim. — Ic.: Gmel. Fl. Sib. II (1749) 236, tab. 97; Prokh., Obz. moloch. tabl. 59. — Exs.: ("E. Kaleniczenkii") G.R.F. No. 2591.

Perennial plants, (12)19–39 cm high, more or less pubescent, bluish-glaucous; root thin, creeping or obliquely descending; stems usually few, ascending at base, more or less spreading or rarely suberect, (9.5)14–25(45) cm high, 1.5–3 mm thick, early becoming naked at the lower part, bearing above (1)4–15 axillary peduncles 1.2–5 cm long, simple below or sometimes with short sterile branches; basal leaves squamiform, brown, deciduous; cauline leaves with petioles up to 0.5 mm long, usually cuneate at base, oblong-elliptic or oblanceolate, 1.4–3.4(4) cm long, (3)4–11(12) mm wide, dilated above, obtuse or hardly cuspidate, cartilaginous at margin, entire or crenulate only near apex, 1-nerved, leaves on sterile branches slightly smaller. Terminal peduncles (5)8–10, 0.8–4.2 cm long, like axillary peduncles once or twice bifurcate; leaves of involucre oblong or ovate or linear-oblong, 0.5–1.5(2.1) cm long, 1.5–4(7) mm wide, obtuse or cuspidate; leaves of involucels 2, cordate or reniform or ovate-rhombic, 4–12 mm long, 6–13(15) mm wide, obtuse or cuspidate; cyathium campanulate, 1.5–2 mm in diameter, glabrous outside or rarely pubescent below, with orbicular, obtuse, ciliate lobes; nectaries dark, crescent-shaped, bicornute, usually with short acute horns, shorter than width of nectary; styles 1–1.5 mm long, connate at base, 2-lobed; schizocarp flattened-ovoid, 2.5–3 mm long, 3–3.5 mm broad, deeply trisulcate, cocci orbicular, rugulose dorsally; seeds ovate, 1.8–2.2 mm long, smooth, brown, with subsessile declinate, inflated-disciform appendage. Fl. second half of May – June, Fr. second half of June – July.

Slopes of steppical gorges, fallow lands. — European part: V.-Don, Transv., L. Don; W. Siberia: U. Tob, Irt. (W.). Endemic. Described (*E. gmelini*) from the Iset' River in W. Siberia. Type in Leningrad.

90. *E. discolor* Ldb. Fl. Ross. III (1849–1851) 577; Turcz. Fl. baic.-dah. II, 360. — *E. Maackii* Meinsh. in Baer u. Helmers. Beitr. zur Kenntn. d. Russ. Reiches, XXVI (1871) 204; Meinsh. in P. Maak; Vilyuisk. okr. Yakutskoi obl. 295; Litv., Spis. rast. G.R.F. VIII, 103. — *E. esula* var. *genuina* auct.; Boiss. in DC. Prodr. XV, 2, 161, p. p. non typ.; Kom., Fl. Man'chzh. II, 689; Prokh. in Izv. Akad. Nauk SSSR (1927) 211, non L. (1753). — *Tithymalus discolor* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 97, nomen altern. — Ic.: Meinsh. l. c. tab. I, f. A. — Exs.: ("E. Maackii") G.R.F. No. 2592.

Perennial glabrous plants, 15–40 cm high; root dark, cordlike, creeping; stems solitary, erect, thin (1–2 mm), rounded and finely striate, sparsely but uniformly leafy (internodes only slightly shorter than leaves), simple below, more or less branching above, with 1–5 thin axillary peduncles 2–5 cm long, if without then with 1–3 short sterile branches; basal leaves delicate [?], squamiform, deciduous; cauline leaves short-petiolate or sessile, long-cuneate at base, linear-spatulate or oblanceolate or narrowly obovate, 1.1–3.5 cm long, 3–10 mm wide (3 to 6 times longer than wide), widest above, obtuse or (especially the lower) truncate or even slightly emarginate, rarely somewhat acuminate, entire, crenate only at apex, incurved at margin, scarious, paler beneath, 1-nerved, leaves on branches almost half the size. Terminal peduncles 3–8(11), thin, 3–7 cm long, like axillary peduncles simple or often with 2(rarely with 1) secondary peduncles; 424 leaves of involucre sessile, oblong-lanceolate or obovate (rarely even orbicular), 8(24) mm long, (3–10(17) mm wide), widest above middle, slightly or much longer (up to 4 times) than wide, obtuse; leaves of involucels 2, broadly cordate at base, suborbicular-reniform, 4–10 mm long, 7–15 mm wide ($1\frac{1}{2}$ to 2 times wider than long), obtuse, sometimes rather shortly mucronate, at first pale, later slightly reddish, usually overlapping at base thus forming regular flat disk; cyathium campanulate, 1.5–2 mm long and broad, with small obtuse ciliate lobes; nectaries dark, crescent-shaped, shortly bicornute; styles 1–1.5(3) mm long, nearly free, bifid; schizocarp turnip-shaped, 2–2.5 mm long, 3–3.5 mm wide, deeply trisulcate, cocci slightly scabrous at back; seeds dark brown, ovate, 1.6–1.8 mm long, smooth, with obtuse conical appendage. Fr. June.

Forests.—W. Siberia: Ob, Alt.; E. Siberia: Yenis., Lena-Kol., Ang.-Say., Dau.; Far East: Kamch., Okh., Ze.-Bu., Uda, Uss. Gen. distr.: Mong., Manchuria. Described from the vicinity of Irkutsk. Type in Leningrad.

91. *E. karoï* Freyn in O. B. Z. XLVI (1896) 58.—*Tithymalus Karoï* (Freyn) Prokh. comb. nova, nomen altern.

Perennial plants, 9–13 cm high, dark glaucous, more or less pubescent up to flowering, glabrous subanthesis; root thin, creeping; stems 1–4 (some sterile), straight or slightly curved, 6–10 cm high, more or less densely covered with short spreading hairs, with or without 1–3(5) axillary peduncles (ca. 3.5 cm long) above, below often with short (1–9 cm long) densely leafy sterile branches, sometimes exceeding inflorescence; basal leaves squamiform, ovate-lanceolate, coriaceous, clearly white or pink; cauline leaves rather sparse, narrowly linear or linear-spatulate, the lower 5–6 mm long, 1–1.5 mm wide, the upper (10) 17–27 mm long, 1–1.5(2) mm wide, increscent, obtuse, entire, but crenulate near apex, glabrous, leaves on sterile branches usually narrower, (10) 12–25 mm long, 0.5–1 mm wide, the upper on radical [sterile?] shoots much larger, up to 8 cm long, 2 mm wide. Terminal peduncles (3) 4–5, 2–3(3.5) cm long, glabrous, like axillary peduncles with 1 or often 2 secondary peduncles; leaves of involucre similar to the upper cauline leaves but shorter or slightly wider, (8) 10–18 mm long, 1–2(2.5) mm wide; leaves of involucels 2, free, cuneate at base, flabelliform-obtriangular (like leaves of ginkgo), 5–8 mm long, 9–15(18) mm wide, irregularly dentate, the median tooth prominently rounded-triangular at apex; cyathium campanulate, ca. 1.5 mm in diameter, with orbicular fimbriate lobes; nectaries

425 dark purple, falcate, curved with 2 long converging horns; styles 1.5–2 mm long, connate for less than $\frac{1}{3}$, deeply bifid; schizocarp globulose-ovoid, ca. 3 mm long and wide, deeply trisulcate, smooth, with orbicular cocci; seeds compressed-ovate, ca. 2 mm long, whitish, smooth, with sessile disciform appendage. Fl. May–June, Fr. June.

Rocks and stony taluses. — E. Siberia: Dau. (Nera River in Nerchinsk in the east). Endemic. Described from the vicinity of Nerchinsk. Type in Vienna, cotype in Leningrad.

92. *E. borszczowii* Prokh. sp. nova in Addenda XIII, 742. — *Tithymalus borszczowii* Prokh. nomen altern.

Perennial plants, 20–30 cm high, glabrous, grayish; stems ascending at base, 2–3 mm thick below, striate-ribbed, simple for only $\frac{1}{3}$ to $\frac{1}{2}$ of the entire length, strongly branching above, at first with 2–3 (rarely up to 11) sterile densely leafy branches, often exceeding inflorescence, later with 4–13 axillary peduncles ca. 3.5 cm long; cauline leaves sessile, more or less rounded at base, broadly linear, 1.8–3.6 cm long, 2.5–8 mm wide ($4\frac{1}{2}$ to 9 times longer than wide), obtuse or acute or truncate, entire, with slightly recurved margins, 1-nerved, leaves on sterile branches narrowly cuneate-spatulate, 1.4–3 cm long, 2.5–6.5 mm wide (4 to 10 times longer than wide), widest at apex, truncate, sometimes the median hardly cuspidate, rarely not truncate but obtuse or acute. Terminal peduncles 7–10, 2.5–4.5 cm long, like axillary peduncles once or twice bifurcate, sometimes developing into sterile shoots toward end; leaves of involucre slightly dilated and rounded at base, linear-spatulate or oblong-ovate, 0.8–2 cm long, 2–5 mm wide (3 to 6 times as long as wide), obtuse or truncate; leaves of involucels 2, rhombic or rarely orbicular-reniform, obtuse, the lower 5.5–8 mm long, (7)10–12 mm wide (usually $1\frac{1}{2}$ times wider than long); cyathium campanulate, 2–2.5 mm long and broad, with oblong obtuse lobes; nectaries dark, shortly bicornute; styles ca. 2 mm long, connate for one-third, deeply bifid; schizocarp and seeds unknown. (Plate XXII, Figure 5.)

Steppes and mountain slopes. — European part: V.-Kama (near Zlatoust in the south), L. V. (near Novouzensk in the north); W. Siberia: U. Tob. (Il'men Mountains in the west). Endemic. Described from the vicinity of Novouzensk. Type in Leningrad.

93. *E. sareptana* Beck. in Bull. Soc. Nat. Mosc. XXXI (1858) 1, 13 (descr. germ. brevis), 68, nomen No. 589; Boiss. in DC. Prodr. XV, 2, 159; Lipskii in Tr. B. S. XIII, 334; Krisht. in Fl. Yugo-Vost. V, 672. — *E. tanaitica* Paczoski in Mat. fl. step. Donsk. obl. (1891) 78. —

426 *E. chimaera* Lipsky in Tr. Tifl. Bot. Sada, IV (1899) 444. — *Tithymalus sareptanus* (A. Beck.) Prokh. comb. nova, nomen altern.

Perennial plants, 10–30 cm high, glaucescent, glabrous (var. *kim-merica*) or rarely (var. *chimera-typica*) shortly velutinous-hairy; root cordlike; stems few or solitary, erect, thin (1–1.5 mm), sparsely leafy, simple, with short sterile basal shoots, above often with 1–3 axillary peduncles (1.5)3.5–5.5 cm long; cauline leaves (except for the upper) cuneate at base, obovate or oblong-spatulate (rarely obcordate), (9)12–38 mm long, (3)5–12 mm wide (2 to 4 times, rarely up to $5\frac{1}{2}$ times, longer than

wide), obtuse or truncate or emarginate, sometimes obsoletely mucronate, rarely somewhat acute, entire, hardly undulate at margin, thick. Terminal peduncles (2)3–5, thin, 2–4.5(5.5) cm long, like axillary peduncles forked once or rarely simple; leaves of involucre (and the upper cauline) oblong or elliptic or linear, (5)9–22 mm long, (1.5)2.5–8 mm wide (2 to 5 times, sometimes up to 9 times, longer than wide), obtuse, truncate or emarginate; leaves of involucels rhombic-reniform, 3–6 mm long, 5–11 mm wide ($1\frac{3}{4}$ to 2 times wider than long), obtuse, often slightly cuspidate; cyathium short-campanulate, 1.5–2 mm in diameter, with short-ovate ciliate lobes; nectaries dark, shortly bicornute; styles 0.8–1 mm long, connate at base, 2-lobed; schizocarp flattened-ovoid, 2.5–3.5 mm long, 3–4 mm wide, deeply trisulcate, cocci tuberculate-dotted; seeds subovate, smooth, with small appendage. May. (Plate XXII, Figure 3.)

Clayey soil in steppe ravines. — European part: L. Don, L. V.; Caucasus: Cisc. (Eisk, Stavropol'), W. Transc. (Novorossiisk, Anapa in the northwest). Endemic. Described from the vicinity of Krasnoarmeisk (formerly Sarepta) on the Volga. Type in Leningrad.

94. *E. latifolia* C. A. M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 25; Fl. alt. IV, 183; Fl. Ross. III, 678; Boiss. in DC. Prodr. XV, 2, 161; Kryl., Fl. Zap. Sib. VIII, 1881. — *Tithymalus latifolius* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 89, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 176. — Ic.: Ldb. Ic. pl. Fl. Ross. tab. 185; Prokh. l. c. tabl. 60.

Perennial plants, 30–100 cm high, glabrous, pale green; stems erect, with axillary peduncles above, below with sterile branches, rarely not oranching; cauline leaves broadly cuneate at base, broadly ovate or ovate-lanceolate, 2.5–5.5 cm long, 1–3 cm wide, generally widest below, obtuse or rounded at apex, rarely abruptly subcuspidate, entire or crenulose near apex, 1-nerved, leaves on sterile branches petiolate, cuneate at base, linear-spatulate, 2–4.5 cm long, 7–15 mm wide, widest above, obtuse or rounded at apex. Terminal peduncles 8–17, erect, like axillary peduncles twice bifurcate; leaves of involucre sessile, broadly elliptic or orbicular-obovate, 1.5–2.1 cm long, 1.2–1.4 cm wide, obtuse; leaves of involucels 2, cordate at base, broadly triangular-ovate or reniform, 8–18 mm long, 15–25 mm wide, obtuse, hardly mucronate, overlapping at base forming a confluent circle, crenulate at margin, yellowish in blossom; cyathium campanulate, 2.5–3 mm in diameter, glabrous outside, short-hairy inside, with orbicular obtuse or emarginate short-ciliate lobes; nectaries dark, crescent-shaped, very shortly bicornute or nearly hornless; styles 1–1.5 mm long, nearly free, with 2 thick lobes; schizocarp ovoid, truncate, 2.5–3 mm long, 3–3.5 mm wide, deeply sulcate, with nearly smooth cocci; seeds oblong, 2–2.5 mm long, smooth, brown, with small flat sessile appendage. May–June.

Banks of rivers and streams, grasslands, mountain slopes usually among shrubby formations. — W. Siberia: Irt. (along Irtysh River in the east), Alt.; Centr. Asia: Balkh. (E.), Dzu.-Tarb., T. Sh. (near Lake Issyk-Kul' in the northeast). Endemic. Described from Kurchum Mountains near Nabati. Type in Leningrad.

95. *E. borodini* Sambuk in Izv. Akad. Nauk SSSR, ser. 7 (1928) 45. — *E. latifolia* auct.; Litw. in Spis. rast. G.R.F. VIII (1922) 131; Krisht. in Fl. Yugo-Vost. V, 675, non Ldb. (1830). — *E. virgata* var. *latifolia* auct.; Kauffm., Moskovsk. flora (1866) 105. — *Tithymalus Borodini* (Sambuk) Prokh. comb. nova, nomen altern. — *Galarhoeus Borodini* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 71, olim. — Ic.: Prokh. l. c. tabl. 13. — Exs.: G.R.F. No. 2663 ("*E. latifolia*").

Perennial plants, 34–77(100) cm high, glabrous, glaucous; root cordlike, obliquely ascending or horizontal; stems usually few, erect, 30–74(95) cm high, 2–4 mm thick at base, densely leafy, with thin internodes 0.4–1 cm long, usually bearing 3–15(20) axillary peduncles (0.4)1–6(8) cm long above, sometimes without, with 3–6 sterile branches; cauline leaves alternate (except for the upper), hardly petiolate, more or less cuneate at base, oblong-obovate or oblanceolate or sometimes linear-oblong or even lanceolate, 2–8(9) cm long, 5–15(20) mm wide, usually widest in the middle or above, obtuse, sometimes hardly cuspidate, subentire, incurved at margin, scarious, dull, with 1 midrib pinnately veined, leaves on sterile branches narrowly oblanceolate or linear-spatulate or sometimes sublinear or lanceolate, 2–5(6) cm long, 2.5–8(10) mm wide, the lower opposite. Terminal peduncles (5)8–12, (0.7)1.5–5.5 cm long, like axillary peduncles simple or forked for once or twice; leaves of involucre similar to the upper cauline leaves (below peduncles), generally longer by half than the adjacent peduncle, more or less rounded at base, linear-oblong or oblong-lanceolate or ovate-elliptic, 1–2.5(5.5) cm long, 4–9(15) mm wide, widest below; leaves of involucels 2, triangular-reniform or broadly orbicular-rhombic or rarely ovate-triangular, more or less acute or obtuse, usually mucronulate, sometimes overlapping at base, pale yellow, the lower (5)6–13(22) mm long, (6)8–18(20) mm wide; cyathium campanulate, 2–2.5 mm long, 2.5–3 mm wide, glabrous outside, lobes orbicular or ovate, truncate, slightly ciliate; nectaries dark brown, crescent-shaped, bicornute, with horns as long as width of nectary or rarely shorter; styles 1.7–2.5(3) mm long, almost half-connnate, dilated above, shallowly bifid; schizocarp ovoid, truncate, 3.5–4.5 mm long, 4.5–5 mm thick, deeply trisulcate, cocci orbicular, tuberculate, dorsally rugulose, glabrous; seeds ovate, 2.5–3 mm long, smooth, brown, with small inflated disciform appendage. Fl. June, Fr. July—first half of August.

Inundated meadows. — European part: Dv.-Pech., U. V., V.-Kama, Transv., V.-Don, L. Don.(E.). Endemic. Described from Pechora near Ust'-Tsyli'ma. Type in Leningrad.

96. *E. poecilophylla* Prokh., Obz. moloch. Sr. Azii (1933) 186. — *Tithymalus poecilophyllus* Prokh., ibid. nomen altern.

Perennial plants, 12–45 cm high, glaucous, glabrous; stems erect, striate, sometimes with short sterile branches above middle; basal leaves squamiform, ovate-triangular, brown, persistent; cauline leaves hardly petiolate, dilated and abruptly attenuate at base, oblong-ovate or orbicular, 1–4 cm long, 9–25 mm wide, widest and paler at base, rounded at apex, entire, coriaceous, shining, 1-nerved, leaves on sterile branches oblong-lanceolate. Terminal peduncles (7)8, ca. 3 cm long, simple or rarely forked at summit; leaves of involucre orbicular-ovate or elliptic, 8–10 mm long, 7–12 mm wide, obtuse, more or less rounded at both ends; leaves of involucels

reniform, 5–10 mm long, 7–18 mm wide (nearly twice as wide as long), obtuse, overlapping at base; cyathium broadly campanulate, 3–4 mm wide, glabrous outside, hairy inside, with small orbicular densely ciliate lobes; nectaries crescent-shaped, bicornute, with horns longer than width of nectary; styles 1.5–2(2.5) mm long, connate only at base, thin, deeply bifid; 429 schizocarp ovoid, truncate, 3–4 mm long and wide, trisulcate, with nearly smooth cocci; seeds ovate, ca. 2.5 mm long, smooth, whitish, with flat short-stalked appendage.

Stony slopes. — Centr. Asia: Pam.-Al. (S.). Endemic? Described from Vakhsh Range south of the Tundak mountain pass. Type in Leningrad.

Series 3. *Lucidae* Prokh. — For characteristics of the series see page 252 of the Key. Type of series: *Euphorbia lucida* W. et K.

97. *E. salicifolia* Host, Syn. pl. Austr. (1797) 267; Ldb. Fl. Ross. III, 578; Boiss. in DC. Prodr. XV, 2, 162; Fl. or. IV, 112; Hegi, Ill. Fl. V, 1, 166. — *Tithymalus salicifolius* (Host) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 89, nomen altern. — Ic.: Waldst. et Kit. Pl. rar. Hung. I, tab. 55; Rchb. Ic. Fl. Germ. V, tab. 149, f. 4798; Hegi, Ill. Fl. V, 1, f. 1775. — Exs.: Fl. exs. austro-hung. No. 508.

Perennial plants, 30–70 cm high; root long, creeping, multicipital; stems high, erect, sparingly pubescent, densely leafy, branching above, with 1–16 axillary peduncles approximately as long as their subtending leaves, often with sterile branches below; cauline leaves sessile, short-attenuate at base, lanceolate or oblong-lanceolate, 5–8.5 cm long, 0.7–2.5 cm wide, widest at the middle or slightly below, tapering above, acuminate but not cuspidate and with obtuse apex, entire, densely short-glandular-pubescent and finely ciliate on both sides, pale greenish-yellow, leaves on branches cuneate at base, oblanceolate (5–15 mm wide). Terminal peduncles 6–18, 1.5–6 cm long, like axillary peduncles repeatedly forked; leaves of involucre elliptic or broadly lanceolate or ovate, obtuse, sometimes short-cuspidate, yellowish at anthesis; leaves of involucels 2, slightly cordate at base, reniform or triangular-reniform, wider than long, obtuse, cuspidate, or acuminate, usually glabrous, bright yellow at anthesis; cyathium ca. 3 mm long; nectaries shortly bicornute, sometimes transversely elliptic, not stalked, waxy-yellow, later purple; styles 1.5–2 mm long, connate below, with 2 thick lobes; schizocarp short-ovoid, ca. 3–5 mm long, shallowly trisulcate, with obscurely rugose (barely dotted-tuberculate) cocci; seeds globular-ovate, smooth, with disciform-orbicular sessile appendage. May.

Meadows, groves, forest edges, among shrubby formations, roadbanks, hedges, plowed fields. — European part: Bes., Bl. Gen. distr.: Centr. Eur., Bal. (N.). Described from E. Austria between Bruck an der Leitha and Neusiedler Lake. Type in Vienna.

98. *E. glomerulans* Prokh., Obz. moloch. Sr. Azii (1933) 183. — *Tithymalus glomerulans* Prokh. ibid. nomen altern. — Ic.: Prokh. l. c. tabl. 63.

430 Perennial plants, 25–70 cm high, glaucous, usually short-hairy; root thick, cylindrical, multicipital; stems few, erect, deeply ribbed-furrowed, usually short-hairy below, glabrous above, branching, with 1–3 axillary

peduncles above and with short sterile branches below; basal leaves squamiform, ovate-triangular, brown, persistent; cauline leaves sessile, rounded or slightly cordate or rarely short-cuneate at base, ovate-lanceolate or elliptic or sometimes broadly ovate, 2–7 cm long, 0.6–2(2.4) cm wide, widest below middle, obtuse or short-cuspidate, entire, coriaceous, shiny, 1-nerved, leaves on sterile branches smaller, narrowly lanceolate. Terminal peduncles 8–18, like axillary peduncles forked for once or twice; leaves of involucre ovate-elliptic or linear-oblong, 1–3 cm long, 5–10 mm wide, usually obtuse; leaves of involucels broadly triangular-ovate or even reniform, 9–15 mm long, 12–20 mm wide, short-cuspidate, often slightly overlapping at base; cyathium broadly campanulate, 2.5–3 mm in diameter, glabrous outside, hairy inside with small orbicular dentate lobes; nectaries dark, crescent-shaped, bicornute, horns subulate, longer than width of nectary; styles 1–1.5 mm long, connate, for $\frac{1}{3}$, 2-lobed; schizocarp ovoid, obtuse, 3.5–4 mm long, 4–4.5 mm wide, deeply trisulcate, sometimes slightly purple, cocci remotely and very finely tuberculate on dorsal surface; seeds ovate, ca. 2.5 mm long, smooth, whitish, with orbicular sessile appendage. May.

Mountain slopes, frequently in river valleys and among shrubby formations. — Centr. Asia: T. Sh., Pam.-Al. **Gen. distr.:** Dzu.-Kash. (Kuldja District). Described from Khodzha-Borku Mountain in the Chul'bair Mountains opposite Yurchi Mountain (Uzbekistan). Type in Leningrad.

99. *E. agraria* M. B. Fl. taur.-cauc. I (1808) 375, III, 326; Ldb. Fl. Ross. III, 579; Boiss. in DC. Prodr. XV, 2, 163; Fl. or. IV, 1128. — *Tithymalus agrarius* (M. B.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 89, nomen altern. — Ic.: Rchb. Pl. crit. III, tab. 251. — Exs.: G. R. F. No. 2593.

433 Perennial glaucescent plants, 25–90 cm high; root creeping; stems many, erect, striate, densely leafy, with 4–18(24) axillary peduncles above, usually simple below, rarely with few short sterile branches; cauline leaves flexible, sessile, obtuse-auriculate or dilated and cordate at base, triangular-ovate or oblong, 2.2–5.5 cm long, (8)15–25 mm wide, obtuse, crenate at the narrowly cartilaginous margin, veined, leaves on sterile branches elliptic. Inflorescence corymbiform; terminal peduncles (6)8–12, thin, like axillary peduncles twice forked; leaves of involucre ovate; leaves of involucels reniform, wider than long, obtuse, mucronate; cyathium turbinate-campanulate, 2.5–3 mm in diameter, villous inside, with ovate ciliate lobes; nectaries crescent-shaped, very shortly bicornute; styles 1.5–2 mm long, nearly half-connate, with 2 thick lobes; schizocarp ovoid, deeply sulcate, cocci finely tuberculate on dorsal surface; seeds with conical appendage. May–June. (Plate XXII, Figure 2).

Steppes, fallow lands, weedy places, stony mountain slopes. — European part: Bes., Bl., Crim. **Gen. distr.:** Centr. Eur. (SE). Described from the Crimea. Type in Leningrad.

100. *E. sewerzowii* Herd. from Prokh., Obz. moloch. Sr. Azii (1933) 188. — *Tithymalus Sewerzowii* Prokh. ibid. nomen altern. — Ic.: Prokh. l. c. tabl. 64.



PLATE XXII. 1—*Euphorbia astrachanica* C.A.M.; 2—*E. agraria* M.B.; 3—*E. sareptana* Beck.; 4—*E. mandshurica* Maxim.; 5—*E. borszczowii* Prokh.

Perennial glabrous plants, 26–70 cm high; stems erect, 4–5 mm thick, often leafless and simple below, above with axillary peduncles; basal leaves squamiform, obtusely triangular, brownish; cauline leaves alternate, deeply cordate and amplexicaul at base, triangular-deltoid or rarely triangular-lanceolate, 2–4(6) cm long, 1–2.5 cm wide (the lower smaller), sometimes as long as wide, long-acuminate, cartilaginous at margin, entire or hardly crenate, somewhat coriaceous, 1-nerved, imbricately overlapping above. Terminal peduncles 7–10, 5–12 cm long, like axillary peduncles bifurcate at summit; leaves of involucre similar to upper cauline leaves; leaves of involucels 2, truncate or short-cuneate at base, reniform-triangular or rarely triangular-rhombic, 7–16 mm long, 7–26 mm wide, cuspidate; cyathium campanulate, 2.5–3 mm in diameter, with small oblong ciliate lobes; nectaries bicornute, with long subulate horns longer than width of nectary; styles 1.5–2 mm long, nearly free, deeply bifid; schizocarp ovoid, obtuse, ovate, 5–6 mm long, trisulcate, with obtusely keeled nearly smooth cocci; seeds ovate, 3–4 mm long, smooth, with small disciform sessile appendage. June.

Stony and meadowy mountain slopes. — Centr. Asia: T. Sh. (Talass and Kara-Tau ranges in the west). Endemic. Described from Kara-Tau Mountains between Arys and Bugun. Type in Leningrad.

101. *E. mandshurica* Maxim. in Bull. Acad. Petersb. XXIX (1884) 203; Kom., Fl. Man'chzh. II, 161.

- 434 Perennial glabrous plants, (25)40–80(90) cm high; root creeping, perpendicular above, multicapital; stems tall, striate, 3–6 mm thick at base, branching above, with 1–5 axillary peduncles 3–10(12) cm long and often under them with 2–6 leafy sterile branches sometimes exceeding inflorescence; cauline leaves hardly petiolate, only slightly longer than internodes, cordate or rarely tapering at base, oblong-ovate or ovate, (1.8)2.6–6 cm long, (8)10–25 mm wide (2 to 4 times longer than wide), obtuse, sometimes short-cuspidate, obscurely crenate at apex, incurved at margin, thick, shiny, branches oblong or narrowly oblanceolate, 2–6.7 cm long, 5–8 mm wide (3 to 5 times longer than wide). Terminal peduncles (5)6–9(11), 2–6(7) cm long, like axillary peduncles twice forked; leaves of involucre (and the upper cauline) cordate at base, oblong or orbicular-ovate, 1–3 cm long, 7–22 mm wide (usually not more than 2 times longer than wide); leaves of involucels cordate at base, overlapping in pairs, reniform or rarely orbicular-triangular, 7–15 mm long, 12–22 mm wide, ($1\frac{1}{2}$ to 2 times wider than long), obtuse; cyathium short-campanulate, 1.5–3 mm long and broad, with distinct truncate ciliate lobes; nectaries dark, crescent-shaped, usually shortly bicornute; styles (1.5)2–2.5 mm long, half-connate, bifid; schizocarp globose-ovoid, 3–3.5 mm long, smooth; seeds ovate-globular, 2–2.5 mm long, 2–2.2 mm wide, smooth, pale brown, with distinct short-conical then incised, short-stalked appendage. Second half of June – first half of July. (Plate XXII, Figure 4.)

Coastal dunes and sandy river deposits. — Far East: Uss. Gen. distr.: Manchuria. Described from Sungari River between Emmake and Kyaure in Manchuria. Type in Leningrad.

102. *E. lucida* Waldst. et Kit. Pl. rar. Hung. I (1802) 54; Ldb. Fl. Ross. III, 578; Boiss. in DC. Prodr. XV, 2, 163; Fl. or. IV, 1127; Hegi, Ill. Fl. V, 1, 172; Kryl., Fl. Zap. Sib. VIII, 1880. — *Tithymalus lucidus* (W. et K.) Kl. et Gke. ex Garke Fl. Deutschl. ed. 4 (1849) 292, nomen altern. — Ic.: Waldst. et Kit. l. c. tab. 54; Rchb. Ic. Fl. Germ. V, tab. 149, f. 4797; Hegi, Ill. Fl. V, 1, f. f. 1780, 1781. — Exs.: Fl. exs. austro-hung. No. 1287.

Perennial glabrous plants, 40–100(130) cm high; root robust, teretiform, black, many-branched, with long thick creeping suckers; stems solitary, erect, robust, rounded, 5–10 mm thick, glabrous, striate, hollow for large part, densely leafy, usually sparsely branching above, with few long axillary peduncles much exceeding the terminal umbel, commonly without sterile branches; cauline leaves sessile, truncate or broadly cordate (or even subauriculate) at base, elliptic-lanceolate or lanceolate, 5–12 cm long, 1–3.2 cm wide, widest in the lower third, gradually tapering upward, acuminate, obtuse at apex, at least the upper cuspidate, entire, transparent and slightly incurved at margin, purely green, shiny above, dull olive-green or yellowish, coriaceous during senescence, with lateral nearly transverse nerves, intricately netted at margin. Inflorescence generally elongate, paniculate; terminal peduncles 6–10, short, like axillary peduncles twice forked; leaves of involucre ovate, hardly cuspidate; leaves of involucels ovate-rhombic or nearly triangular-ovate or reniform, as wide as long or wider, obtuse, cuspidate or short-acuminate, yellowish-green; cyathium short-campanulate, 3–4 mm long, villous inside, with large truncate or emarginate lobes; nectaries yellow, later brownish-yellow, crescent-shaped, 1.5–2 mm long, with thin cylindrical horns as long (ca. 1 mm) as width of nectary, rarely nectaries transversely elliptic; styles (2) 2.5–3 mm long, connate below, deeply bifid; schizocarp ovoid, (3) 4.5–5 mm long, not flattened, deeply trisulcate, glabrous, cocci tuberculate-dotted on dorsal surface; seeds globular-ovate, ca. 2.5 mm long, 2 mm wide, smooth, yellowish-light brown, with oblong conical appendage. May–July.

Swampy meadows, willow groves, streambanks. — European part: U. Dnp., U. Dns., M. Dnp.; W. Siberia: Ob (near Tyumen'). Gen. distr.: Centr. Eur., Bal. (N.). Described from Hungary. Type in Budapest.

Note. The study of these W. Siberian plants revealed nothing to distinguish them from the C. European population; thus there is a huge disjunction in the distribution area of the given species within the European part of the USSR.

103. *E. iberica* Boiss. Cent. Euph. (1860) 38, et in DC. Prodr. XV, 2, 163; Fl. or. IV, 1127. — *E. latifolia* Ldb. Fl. Ross. III, 579, p. p. non typ. — *E. salicifolia* β . *latifolia* Ldb. l. c. 578. — *Tithymalus ibericus* (Boiss.) Prokh. comb. nova, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 107.

Perennial plants, ca. 30 cm high, glabrous, glaucous; root thin, creeping; stems erect, strongly ribbed-furrowed, branching, bearing above axillary peduncles, with densely leafy sterile branches at the middle; cauline leaves sessile, rounded at base, oblong, 2.5–3.8 cm long, 2–2.2 cm wide, obtuse or acute, obscurely crenate near apex, slightly incurved at margin, thick,

shiny above, distinctly pinnately veined beneath, leaves on branches truncate, not tapering, at base linear. Terminal peduncles numerous, short, like axillary peduncles bifurcate at summit; leaves of involucre 436 short-ovate; leaves of involucels cordate at base, reniform, obtuse, mucronate, more or less yellowish; cyathium campanulate, with ovate subtruncate fimbriate lobes; nectaries crescent-shaped, with short divergent horns; styles half-connate, dilated above, 2-lobed; schizocarp strongly flattened, deeply trisulcate, cocci orbicular, tuberculate-dotted at dorsal surface; seeds ovate, black, smooth, with subglobular or transversely oblong appendage slightly wider across.

Moist meadows. — Caucasus: Cisc., Dag., W., E. and S. Transc., Tal. Gen. distr.: As. Min. (E.), Iran. (N.). Described from near Kirovabad. Type in Geneva.

104. *E. pseudagraria* P. Smirn. in Byull. Mosk. Obshch. Isp. prir. XLIX, 2 (1940) 85. — *E. iberica* auct.; Krisht. in Fl. Yugo-Vost. V (1931) 673, non Boiss. (1860). — *Tithymalus pseudagrarius* (P. Smirn.) Prokh. comb. nova, nomen altern. — *Galarhoeus pseudagrarius* (P. Smirn.) Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 68, olim. — Ic.: Prokh. l. c. tabl. 12. — Exs.: ("E. leptocaula var. Bogdani Litw.") G. R. F. No. 2586c.

Perennial plants, 12–62(71) cm high, glabrous, glaucous; root generally nearly cordlike, horizontal or obliquely descending; stems erect, 10–57(69) cm high, 2–4 mm thick below, bearing above 2–12 axillary peduncles (1–7.5 cm long), simple below or with few short sterile branches; cauline leaves subsessile, dilated or rounded at base (except for the upper) narrowly lanceolate or ovate-lanceolate or oblong-ovate, 1.6–6.8 cm long, 5–22 mm wide, acute or sometimes obtuse, cartilaginous at margin, hardly crenate, slightly incurved, thick, shiny above, with 1 prominent nerve white at lower side of leaf, leaves on sterile branches linear or linear-lanceolate or oblong-lanceolate, 7–42 mm long, 1–10 mm wide. Terminal peduncles 5–10, 1–7 cm long, like axillary peduncles simple or bifurcate at summit; leaves of involucre similar to the upper cauline (under peduncles), ovate or oblong-lanceolate or oblong, approximately half as long as the adjacent peduncles, 6–30(45) mm long, 3–15 mm wide, obtuse or rarely acute; leaves of involucels 2, more or less cordate at base, reniform or orbicular-triangular (the lower 5–15(20) mm long, 7–20(25) mm wide), obtuse, sometimes short-cuspidate, usually overlapping at base; cyathium campanulate, 2.5–3 mm long, 3–4 mm in diameter, glabrous, with orbicular (ca. 1 mm) ciliate lobes; nectaries crescent-shaped (2–2.5 mm long), bicornute, horns subspatulate, often crenate at apex, longer than width of nectary; styles 437 1.5–3 mm long, nearly half-connate, 2-lobed; schizocarp flattened-ovoid, 3–4 mm long, 4–5 mm wide, trisulcate, cocci orbicular, dorsally slightly rugose-tuberculate, hairy at first, later glabrous; seeds ovate, 2.2–2.8 mm long, smooth, brownish, with small convex-disciform appendage. Fl. May – first half of July, Fr. second half of May – first half of July.

Grassy steppes, fields and fallowlands, ravines and stony slopes, sometimes on chalk, rarely in forest glades, within the chernozem belt. — European part? V.-Don (Zhiguli in the east, doubtful), Transv., L. Don; W. Siberia: U. Tob. (W.). Endemic. Described from the sources of Golubaya River in Sirotinskaya District, Stalingrad Region. Type in Moscow at the University herbarium.

Series 4. *Virgatae* Prokh. — Characteristics of the series on page 252 of the Key. Type of series: *Euphorbia virgata* W.K.

105. *E. uralensis* Fisch. ex Link, Enum. horti berol. II (1822) 14; Krisht. in Fl. Yugo-Vost. V, 676; Kryl., Fl. Zap. Sib. VIII, 1876. — *E. virgata* var. *uralensis* Ldb. Fl. Ross. III (1849–1851) 576; Boiss. in DC. Prodr. XV, 2, 160; Fl. or. IV, 1126; Korsh. Tent. Fl. Ross. or. 377. — *Tithymalus uralensis* (Fisch. ex Link) Prokh., Obz. moloch. Sr. Azii (1933) 203, nomen altern. — *Galarhoeus uralensis* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 54, olim. — Ic.: Gmel. Fl. Sib. II (1749) tab. 96, f. 1–2; Krisht. l. c. tabl. 471; Prokh., Obz. moloch. tabl. 63. — Exs.: G. R. F. No. 1384.

Perennial plants, (20)40–100 cm high, glabrous, dark green; root cylindrical; stems few or many, erect, (18)35–96 cm high, 3–8(10) mm thick at base, virgate, becoming leafless and woody below, partly more or less reddish, tapering upward, branching above, with 1–16(25) axillary peduncles 0.7–6 cm long, below with numerous long, densely leafy, ascending, branches, the lower usually sterile, the upper at first leafy and later with small cymose umbels at the same level of inflorescence of main stem or sometimes even higher; cauline leaves (except for the upper) hardly petiolate, usually narrowly cuneate at base, narrowly linear or linear-oblong, 2.5–8.5 cm long, 1–5(7) mm wide, acute or cuspidate, usually scarious, cartilaginous at margin, subentire and only at apex finely crenate, 1-nerved, leaves on branches more dense, linear-lanceolate or narrowly oblong-lanceolate or narrowly linear, sometimes nearly setaceous, 1.5–4.5 cm long, 0.5–3 mm wide, acute or acuminate. Terminal peduncles 3–12 (usually 5), 0.7–4 cm long (on branches 0.3–1.7 cm), like axillary peduncles forked for 1–3 times; leaves of involucre and also upper cauline (under peduncles) sessile, rounded or (especially the upper cauline) slightly dilated at base, linear or narrowly lanceolate or triangular-lanceolate, 0.7–3 cm long, 1.5–4 mm wide, acuminate or acute; leaves of involucre deltoid or triangular-ovate or broadly reniform, 4–12 mm long, 3–11 mm wide, acuminate or short-cuspidate, lighter in color, on axillary peduncles often triangular-lanceolate (up to 22 mm long); cyathium campanulate, 1.5–2.5 mm in diameter, glabrous, lobes orbicular or oblong, obtuse, generally crenate, glabrous; nectaries crescent-shaped, sometimes crenate outside, bicornate, at the dilated apex horns linear-spatulate, cleft or 2–3-dentate, usually diverging, distinctly longer than width of nectary (up to 2 times); styles 1–1.5 mm long (rarely longer), half-connate, 2-lobed; schizocarp ovoid, truncate, 3–3.5 mm long, 3.5–4 mm wide, deeply trisulcate, with nearly smooth orbicular cocci; seeds oblong-ovate, 2.2–2.8 mm long, smooth, brown, with small convex disciform appendage. Fl. June–July. Fr. second half of June–July–August.

Riverbanks, oxbow lakes, fluvial meadows (often salinized depressions), beach pebbles (Volga, along the so-called riverside belt), coastal shrubby formations and riparian forests, bottoms of ravines, sometimes in steppe sink holes, weedy fallowlands, among crops. — European part: V.-Don (only on the Volga in the east), Transv. (SE), Bl. ?, L. Don, L. V.; W. Siberia: U. Tob., Irt., Alt. (rare); Centr. Asia: Ar.-Casp. (N.), Balkh. (NW). Endemic. Described from the Ural Mountains. Type in Berlin.

106. *E. pamirica* Prokh., Obz. moloch. Sr. Azii (1933) 198. — *Tithymalus pamiricus* Prokh. *ibid.* nomen altern.

Perennial glabrous, bluish-glaucous plants, 17–60 cm high; root cylindrical, vertical or obliquely descending; stems few, erect, branching for the entire length (mainly from base), above with axillary peduncles, below with many short sterile branches; basal leaves squamiform, brown, deciduous; cauline leaves sessile, slightly dilated, rounded or hardly cordate at base, linear-elliptic or rarely subulate-linear, 1.5–5 cm long, 1.5–4 mm wide, acuminate, entire, 1-nerved, leaves on sterile branches linear-filiform, 0.8–2 cm long, 0.3–2 mm wide, more or less bent. Terminal peduncles 8–11, like axillary peduncles bifurcate at summit; leaves of involucre slightly dilated at base, elliptic or linear-oblong, 1–1.5 cm long, 2–5 mm wide, rounded or hardly cuspidate at apex; leaves of involucels triangular- or orbicular-reniform, 5–8 mm long, 6–11 mm wide, obtuse or cuspidate; cyathium campanulate, 3–4 mm in diameter, glabrous, with orbicular fimbriate lobes; nectaries crescent-shaped, 439 bicornute, horns spatulate, obtuse, longer than width of nectary; styles 1–1.5(2) mm long, nearly half-connate, hardly 2-partite; schizocarp ovoid, truncate, ca. 4 mm long, trisulcate, shiny, with nearly smooth cocci; seeds ovate, ca. 3 mm long, smooth, whitish, brown-spotted, with disciform rufous-short-stalked appendage. June.

Stony slopes in the subalpine belt. — Centr. Asia: Pam.-Al. (Shugnan, Roshan and Darvaza in the south). Endemic? Described from the area between Duzak-Dara pass and Vodzh in Shugnan. Type in Leningrad.

107. *E. cyparissias* L. Sp. pl. (1753) 461; Ldb. Fl. Ross. III, 574; Boiss. in DC. Prodr. XV, 2 (1862) 160; Hegi, Ill. Fl. V, 1, 167. — *Tithymalus cyparissias* (L.) Scop. Fl. carn. ed. 2, I (1772) 339, nomen altern.; Lam. Fl. Fr. III, 96. — *Galarhoeus cyparissias* Small ex Rydb. Fl. Praeries and Plains centr. N. Amer. (1932) 520; Prokh. in Tr. Kuibys. Bot. Sada, I, 53, olim. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 147, f. 4793; Hegi, Ill. Fl. V, 1, f. f. 1777, 1778. — Exs.: G. R. F. No. 338; Pl. Finl. exs. No. 779; Fl. Stir. exs. No. 1195; Fl. Pol. exs. No. 874.

Perennial plants, 15–30 cm high, glabrous or rarely sparingly pubescent, grayish-green; root cylindrical, creeping, branching; stems usually many, erect, 15–24 cm high, 2–3 mm thick at base, strongly branching from base, with or without 1–12 axillary peduncles above, 1–2.5 cm long, below densely leafy, usually with many sterile branches; basal leaves squamiform, cauline leaves subsessile, narrowly linear, 1.4–2.6 cm long, usually 1–2 mm wide throughout, obtuse, incurved at margin, scarious, dull, 1-nerved, often slightly bent, leaves on sterile branches many, 1.4–1.8 cm long, 0.1–0.5 mm wide. Terminal peduncles 10–18 (rarely less than 10), 0.5–2(3) cm long, like axillary peduncles once or twice forked or rarely simple; leaves of involucre sometimes somewhat auriculate at base, linear-lanceolate, 9–17 mm long, 1–2 mm wide, incurved at margin; leaves of involucels ovate-rhombic or orbicular-cordate (the lower 3–5 mm long, 4–7.5 mm wide), obtuse or cuspidate, rather pale, yellowish or often more or less purple; cyathium campanulate, 1.5–2 mm long and broad, with small orbicular ciliate lobes; nectaries bicornute, with short obtuse horns about half as long as width of nectary; styles up to 1 mm long, connate below, shortly

2-partite; schizocarp ovoid, truncate, ca. 3 mm long, trisulcate, typically finely tuberculate. May–June, rarely in the fall.

Pine forests, fallow lands, sandy soil. — European part: U. Dns., U. V.(W.), U. Dnp. (S.), M. Dnp., V.-Don, L. Don (N.). Gen. distr.: Scand. (S.), Centr. 440 and Atl. Eur., W. Med. (N.), Bal., introduced into N. Am. Described from near Meissen in Saxony, Bohemia and Switzerland. Type in London.

108. *E. astrachanica* C. A. M. ex Claus, Fl. Wolg. (1851) 254. — *E. praecox* Fisch. Cat. Gorenk. (1812) 65, nomen; Krisht., in Fl. Yugo-Vost. V, 669. — *E. leptocaula* var. *praecox* Boiss. in DC. Prodr. XV, 2 (1862) 159. — *Tithymalus astrachanicus* (C. A. M. ex Claus) Prokh. comb. nova, nomen altern.

Perennial plants, 10–22 cm high, short-hairy, glaucous; root thin, creeping; stems more or less spreading, sometimes hardly developed ($\frac{1}{4}$ – $\frac{3}{4}$ of the entire height), thin (1 mm), strongly branching from base, below with short leafy branches, above with 1–3 axillary peduncles 3–8.5 cm long; basal leaves squamiform; cauline leaves sessile, attenuate or (especially the upper) more or less dilated at base, linear, 1.7–4(5) cm long, 1.5–6 mm wide (6 to 20 times longer than wide), usually widest below middle, acuminate, incurved at margin, with 1 prominent nerve, leaves of lateral shoots narrowly linear, 0.5–1.5 mm wide. Inflorescence loose, spreading; terminal peduncles 2–4 (usually 3), (1.5)3–4(5) cm long, like axillary peduncles forked for 1–3 times, with secondary peduncles often slightly shorter than the primary lower ones; leaves of involucre attenuate and auriculate-dilated at base, linear or linear-lanceolate, 1–4 cm long, 5–6 mm wide (4 to 15 times longer than wide), acuminate; leaves of involucels 2, varying in shape, the lower rhombic or rhombic-triangular or triangular-lanceolate, 6–12 mm long, 5–9 mm wide (up to $2\frac{1}{2}$ times longer than wide) or rhombic-reniform, 4–10 mm long, 6–15 mm wide (twice as wide as long), the upper reduced, rhombic-ovate or transversely rhombic-oblong; cyathium 1.5–2 mm long and broad, with ovate, obtuse, ciliate lobes; nectaries dark, crescent-shaped, bicornute, with short horns, sometimes as long as width of nectary; styles 0.8–1 mm long, connate at base, 2-lobed; schizocarp generally more or less dark, flattened-ovoid, 3–3.5 mm long, 3.5–4 mm wide, deeply trisulcate, with finely tuberculate-dotted cocci; seeds oblong, ca. 3 mm long, smooth, appendaged. May. (Plate XXII, Figure 1.)

Hilly slopes, in steppes on clayey and salinized soil. — European part: L. V. Endemic. Described from near Astrakhan. Type in Leningrad.

109. *E. tshuiensis* (Prokh.) Serg. in Kryl., Fl. Zap. Sibiri, VIII (1935) 1880. — *Tithymalus tshuiensis* Prokh. in Sistem. zam. Gerb. Tomsk. un. (1933) Nos. 3–4, p. p. — *Euphorbia esula* var. *caesia* Boiss. in DC. Prodr. XV, 2 (1862) 161, non *E. caesia* Kar. et Kir.

441 Perennial plants, 7–15 cm high, bluish-glaucous, glabrous; root obliquely descending, rather thin, branching, multicapital; stems solitary or few, reduced ($\frac{1}{2}$ to $\frac{2}{3}$ of the entire length), rarely more developed, erect or ascending, sometimes somewhat flexuous, strongly sulcate, not branching below, with leaf scars, densely leafy and branching above, with 1 or few sterile branches, 1–9 cm long, sometimes exceeding inflorescence, other

branches developed like axillary peduncles; basal leaves squamiform, deciduous; cauline leaves dense and approximate, subsessile, slightly tapering at base, lanceolate-linear or spatulate-elliptic, 6–20 mm long, 2–5 mm wide, rounded and short-mucronate at apex, crenate or subentire, somewhat coriaceous, obscurely 1-nerved, rugose at surface, leaves on sterile branches more dense, subpetiolate, small, falcate-linear, 0.5–1.5 mm wide, acuminate. Terminal peduncles (5)8, like axillary peduncles several times longer than adjacent leaves, forked twice or thrice forked; leaves of involucre tapering at base, obovate or oblong-elliptic, 6–11 mm long, 2–6 mm wide, short-cuspidate or obtuse; leaves of involucels 2, rounded or slightly cordate or cuneate at base, transversely elliptic or triangular-ovate, 3–6 mm long, 4–12 mm wide, acuminate or obtuse, mucronate; cyathium campanulate, 2–3 mm in diameter, with oblong, curled, hardly ciliate lobes; nectaries dark, crescent-shaped, bicornute, with short obtuse horns; styles 1–1.5 mm long, connate below, 2-partite; schizocarp ovoid, truncate, 3–4 mm long, deeply trisulcate, cocci orbicular, scabrous only dorsally; seeds ovate, 2–2.5 mm long, smooth, brown, with obtuse conical appendage. Fl. July – 1/2 August, Fr. second half of July–August.

Dry stony slopes in steppes and old moraines. — W. Siberia: Alt. (Chuya steppe). Endemic. Described from barren, stony places in the Chuya desert in Altai. Type in Leningrad.

Note. Despite the presence of transitional forms, this species is usually distinguished from the related *E. subcordata* Ldb. by a lower habit and very glaucous, glabrous leaves closely (imbricately) disposed, not dilated at base.

110. *E. cyrtophylla* Prokh. in Izv. Gl. Bot. Sada SSSR, XXIX (1930) 556. — *Tithymalus cyrtophyllus* Prokh. ibid. nomen altern.; Prokh., Obz. moloch. Sr. Azii, 191. — Ic.: Prokh. l. c. tabl. 65.

Perennial plants, glabrous, glaucous; root long, rather thick, multicapital; stems many, erect, 15–30 cm high, finely sulcate, branching for the entire
442 length, above with few (ca. 3) ascending peduncles, below with long antrorse, densely leafy sterile branches often reaching inflorescence; basal leaves squamiform, triangular-ovate, scarious, more or less reddish, persistent; cauline leaves sessile, more or less oblique and slightly cordate at base, ovate-lanceolate or linear-lanceolate, 7–25 mm long, 3–7 mm wide, acuminate, hardly incurved at margin, 1-nerved, leaves on branches linear, 1–2 mm wide, usually arcuate. Terminal peduncles (4)8–15, 2–6 cm long, like axillary peduncles simple or forming a bostryx at apex with only single (rarely 2) secondary peduncles; leaves of involucre more or less oblique, ovate-lanceolate or rhombic-ovate, 7–22 mm long, 3–7 mm wide; leaves of involucels 2, transversely elliptic or broadly cordate, 5–6 mm long, 9–12 mm wide, obtuse or sometimes short-cuspidate, paler in color, yellow-green; cyathium broadly campanulate, 3–4 mm long, slightly pubescent, lobes triangular-ovate, obtuse or emarginate, dentate, finely ciliate; nectaries hardly pubescent, bicornute, with short obtuse horns; styles (1.5)2–3 mm long, nearly half-connate, hardly 2-lobed; schizocarp ovoid, truncate, 4–5 mm long, trisulcate, cocci more or less keeled, lobes dorsally rugose; seeds ovate, ca. 2 mm long, smooth, with flattened conical sessile appendage.

Stony places in the alpine mountain belt (2,000–3,500 m elevation). — Centr. Asia: Pam.-Al. (Gissar Range). Described from Mausarif on Gissar Range. Type in Leningrad.

111. *E. guntensis* Prokh., Obz. moloch. Sr. Azii (1933) 201. — *Tithymalus guntensis* Prokh. *ibid.* nomen altern. — Ic.: Prokh. l. c. tabl. 76.

Perennial, glabrous, glaucous plants; root obliquely descending; stems few, erect, 10–18 cm high, naked below and with leaf scars, simple; cauline leaves hardly petiolate, usually cuneate at base, linear, 3.5–5 cm long, 1–3.5 mm wide, short-cuspidate or rarely obtuse, the upper leaves acuminate and the lower broadly spatulate, all entire, obscurely serrate at apex, with 1 nerve protruding below. Cyathia solitary at ends of shoots, rarely 2; leaves of involuclers elliptic-lanceolate, 5–10 mm long, crisp-crenate, yellowish; cyathium broadly campanulate, ca. 4 mm in diameter, glabrous outside, with short obtuse lobes; nectaries crescent-shaped, bicornute (8 altogether in type), with short obtuse horns. August.

Steep slopes. — Centr. Asia: Pam.-Al. (Gunt River valley in the south). Endemic. Described from the Gunt River valley, between the mouth of the Tokus-Bulak and Chatym. Type in Leningrad.

443 Note. This is a doubtful species owing to the fact that it was described from only an incomplete fruitless specimen. It is possible that it is only an impoverished form of *E. pamirica*. Further search in its traditional habitat is desirable.

112. *E. leptocaula* Boiss. in DC. Prodr. XV, 2 (1862) 159; Fl. or. IV, 1125; Korsh. Tent. Fl. Ross. or. 376; Krisht. in Fl. Yugo-Vost. V, 671. — *E. tenuifolia* auct.; M. B. Fl. taur.-cauc. I (1808) 372, III, 323; Ldb. Fl. Ross. III, 571; non Lam. (1790). — *Tithymalus leptocaulus* (Boiss.) Prokh. comb. nova, nomen altern. — *Galarhoeus leptocaulus* Prokh. in Tr. Kuibysh. Bot. Sada, I (1941) 46, olim. — Ic.: Boiss. Ic. Euph. tab. 105.

Perennial plants, 18–40 cm high, glaucous, glabrous or short-hairy; root cordlike, creeping; flowering stems solitary, erect, 15–37 cm high, thin (1–1.5 mm), sometimes with short leafy sterile shoots at base, simple (very rarely only with 1 lateral shoot), with 1–7 axillary peduncles above, 2.5–6.5 cm long; cauline leaves few, slightly longer than internodes, tapering or (the upper) slightly dilated at base, narrowly linear or even sub-filiform, 3.5–7(9) cm long, 1–3.5 mm wide, (15)30–50(65) times longer than wide, gradually acuminate, acute, with incurved margins, 1-nerved. Terminal peduncles (2)3–5(6), unequal in length (1.5–6.5 cm), like axillary peduncles simple or bifurcate at summit, with elongate secondary peduncles, sometimes much smaller than the lower primary peduncles; leaves of involucre auriculate-dilated at base, linear-lanceolate, unequal (6–35 mm), 1.7–4 mm wide, (3)6–13(17) times longer than wide, acuminate; leaves of involuclers 2, deltoid-rhombic or rhombic-reniform, 4.5–8(9) mm long, 8–14 mm wide ($1\frac{1}{2}$ –2 times wider than long or rarely hardly wider), abruptly more or less cuspidate, often angular at margins; cyathium campanulate, ca. 2 mm long, 2–2.5 mm in diameter, with small ciliate lobes;

nectaries dark, crescent-shaped, curved with two usually diverging subulate horns as long as width of nectary; styles 1.2–1.5 mm long, nearly free, bifid; schizocarp flattened-ovoid, 3–4 mm long, 3.5–4.5 mm wide, deeply trisulcate, glabrous, cocci slightly scabrous-rugose at their dorsal surface; seeds ovate, ca. 2 mm long, 1.5 mm wide, smooth, light brown, with small disciform sessile appendage. Second half of April–first half of June.

Dry steppes, often in fallow lands. — European part: Bl., Crim., L. Don, L. V., Transv. (S.); Caucasus: Cisc. Endemic. Described from the Crimean steppes. Type in Geneva.

113. *E. virgata* Waldst. et Kit. Pl. rar. Hung. II (1805) 176; Ldb. Fl. alt. IV, 181; Fl. Ross. III, 575; Boiss. in DC. Prodr. XV, 2, 159; 444 Fl. or. IV, 1126; Korsh. Tent. Fl. Ross. or. 377; Hegi, Ill. Fl. V, 1, 173; Kryl., Fl. Zap. Sib. VIII, 1874. — *Tithymalus virgatus* (W. et K.) Kl. et Gke. ex Garcke, Fl. Deutschl. ed. 4 (1849) 292, nomen altern. — *Galarhoeus virgatus* Prokh. in Izv. Kuibysk. Bot. Sada, I (1941) 58, olim. — Ic.: Waldst. et Kit. l. c. tab. 162; Rchb. Ic. Fl. Germ. V, tab. 1147, f. 4792; Hegi, Ill. Fl. V, 1, f. f. 1782–1785. — Exs.: Fl. exs. austro-hung. No. 1286 (var. *linearis* Schmalh.) G. R. F. No. 2590.

Perennial plants, (25)35–73(100) cm high, glabrous, glaucescent; root vertical or obliquely descending, branching, multicapital; stems few, erect, (22)32–70(95) cm high, virgate, becoming leafless below, 2–5(6) mm thick at base, nearly not tapering upward, branching above with (1)5–20 axillary peduncles 0.6–5(6.5) cm long, sometimes more or less adjacent, below with or without 3–7(20) short sterile branches 3–7(15) cm long, rarely terminated by accessory cymose umbels; basal leaves squamiform; cauline leaves hardly petiolate or sometimes sessile (except for the upper), abruptly attenuate at base, linear or linear-lanceolate or spatulate-linear, 2–9 cm long, 2–10(12) mm wide, widest below, more or less acuminate or rarely abruptly short-cuspidate, with acute flat margin, entire or slightly serrate, rather thick, glabrous, opaque, with lateral nerves at a very acute angle (15–30°) to midrib, leaves on sterile branches narrowly linear or linear, 1.5–3.5 cm long, 1–4 mm wide, acute or acuminate. Terminal peduncles (4)5–15 (usually 8), (3)7–45(55) mm long, like axillary peduncles 1–2 times (rarely thrice) forked or sometimes simple at summit; leaves of involucre and upper cauline leaves (under peduncles) sessile, dilated-rounded at base, elliptic or linear-oblong or lanceolate or ovate-rhombic, 7–30(35) mm long, 2–10(13) mm wide, acuminate or acute, green; leaves of involucels 2, broadly reniform or broadly ovate-triangular or rhombic-ovate, 5–42 mm long, 5–20 mm wide, wider than long, more or less obtuse, mucronulate, attached or separate at base, yellowish-green; cyathium campanulate, 2–2.5(3) mm long, 1.5–2 mm in diameter, glabrous outside, lobes ovate or orbicular (0.5–1 mm), usually truncate, short-ciliate; nectaries green at first, later yellow, olive or brown-violet, crescent-shaped, bicornute, horns linear-spatulate, obtuse or apically 2–3-dentate, diverging, more or less longer (sometimes up to twice) than width of nectary; styles (1.5)2–3.5 mm long, connate for one-third, deeply bifid; schizocarp ovoid, obtuse, 3–4 mm

long, 4–4.5 mm thick, deeply trisulcate, with orbicular cocci, dorsally
445 finely tuberculate, smooth at sides; seeds globular-ovate, 1.8–2 mm long, smooth, brown-violet, with small reniform sessile appendage. Fl. June and August (rarely July), Fr. July and second half of August – first half of September (rarely first half of August).

Fields and crops, fallow lands and pastures, weedy places at roadsides, slopes of hills and ravines in steppes, forb steppes, shrubby formations, forest edges, grass plots in forests, often on sandy and limestone soil. – European part: Dv.-Pech. (introduced into the south), Lad.-Ilm. (introduced), U. V., V.-Kama (S.), U. Dnp., Balt. (introduced), M. Dnp., V.-Don, Transv., U. Dns., Bl., Crim., L. Don, L. V.; Caucasus: Cisc.; W. Siberia: Ob (S. and E.), U. Tob., Irt., Alt. (N.); E. Siberia: introduced into Ang.-Say. (near Minusinsk in the west); Far East: introduced into Uss. Gen. distr.: Centr. Eur., Bal.-As. Min. Described from Hungary. Type in Budapest.

114. *E. boissieriana* (Woron.) Prokh. comb. nova. – *Tithymalus Boissierianus* Woron. Herb. Fl. Cauc. (1931) No. 479. – *E. virgata* var. *orientalis* Boiss. in DC. Prodr. XV, 2 (1862) 160; Fl. or. IV, 1126. – *Tithymalus hypoleucus* Prokh., Obz. moloch. Sr. Azii (1933) 199. – Exs.: ("E. virgata var. orientalis") Fl. cauc. exs. No. 267; Herb. Fl. Cauc. No. 479.

Perennial plants, (25)40–140 cm high, glabrous, glaucescent; root thick-cylindrical, vertical; stems few, erect, more or less ribbed-sulcate, 3–6 mm in diameter, above with 4–8(16) usually approximate axillary peduncles 2–9 cm long, slightly below with short sterile branches; basal leaves squamiform, few, deciduous; cauline leaves erect (except for the upper), short-petiolate, lanceolate or linear-oblong, 3–8(11.5) cm long, 4.5–13 mm wide (6 to 10 times longer than wide), widest below middle, obtuse, mucronulate, entire, slightly incurved at margin, flexible, dull above, paler beneath, with 1 whitish nerve discernible only below, leaves on sterile branches 1.5–3(5) cm long and 2–4 mm wide. Terminal peduncles (7)8–14, 1.5–6(11) cm long, like axillary peduncles forked for 2–3 times; leaves of involucre resembling the upper cauline leaves (under peduncles), sessile, rounded or slightly cordate at base, oblong-ovate or oblong-elliptic, 1.3–2.8 cm long, 3–8(12) mm wide ($2\frac{1}{2}$ to 5 times longer than wide), more or less rounded or nearly truncate at apex, sometimes mucronulate; leaves of involucels 2, triangular-reniform or rarely rhombic-triangular, rounded or obtuse, hardly mucronate, entire, somewhat yellowish, the lower 6–13 mm long, 8–22 mm wide ($1\frac{1}{2}$ to $1\frac{3}{4}$ times wider than long); cyathium campanulate, ca. 3 mm in diameter, glabrous outside, with ovate dentate lobes; nectaries bicornute, with spatulate-linear horns slightly longer than width of nectary; styles 1.5–2(2.5) mm long, connate for one-third, bifid; schizocarp flattened-globulose, 4.5–5 mm long, 5.5–6 mm wide, deeply trisulcate, with nearly smooth cocci; seeds ovate, with orbicular, later rostriform appendage. May–June.

446

Mountain slopes, fallow lands. – Caucasus: Dag., E. and S. Transc., Tal.; Centr. Asia: Kara K. (southeast: Chikishlyar), Mtn. Turkm. Gen. distr.: As. Min., Arm.-Kurd., Iran. (N.). Described from the environs of Tbilisi. Type in Leningrad.

115. *E. jaxartica* Prokh., Obz. moloch. Sr. Azii (1933) 192. — *Tithymalus jaxarticus* Prokh. ibid. nomen altern. — Ic.: Prokh. l. c. tabl. 66. — Exs.: H.F.A.M. No. 307 ("E. virgata var. orientalis").

Perennial glaucous plants, more or less pubescent; root thick, vertical or obliquely descending; stems many or few, erect, 30–100 cm high, not branching below and more or less pubescent, up to 6 mm thick, usually glabrous and branching above, sparingly leafy, with more or less long internodes, with few axillary peduncles above, below with short sterile branches; cauline leaves (except for the upper) hardly petiolate, short-cuneate at base, linear, 4–13 cm long, 2–7(10) mm wide (10 to 25 times longer than wide), slightly acuminate or obtuse or sometimes short-cuspidate, incurved at margin, entire, somewhat coriaceous, glabrous or rarely pubescent, with 1 nerve discernible only below, leaves on sterile branches rather dense, narrowly linear. Terminal peduncles 5–2(15), like axillary peduncles forked for twice or three times; leaves of involucre, like upper cauline leaves (under peduncles), more or less reduced, sessile, slightly dilated and rounded at base, linear-lanceolate or oblong-elliptic or sometimes linear, 1.2–2(5) cm long, 1–6 mm wide, obtuse or hardly cuspidate; leaves of involucels 2, cordate at base, broadly ovate-triangular or reniform, 6–16 mm long, 8–20 mm wide, abruptly cuspidate, overlapping at base; cyathium campanulate, ca. 3 mm wide, glabrous outside, hairy inside, with oblong, obtuse or emarginate ciliate lobes; nectaries yellowish, crescent-shaped, bicornute, with subulate horns longer than width of nectary; styles 2–3 mm long, half-connate, shortly bifid; schizocarp ovoid, obtuse, 3.5–4.5 mm long, 4–5 mm wide, trisulcate, cocci orbicular, distinctly tuberculate at dorsal surface; seeds compressed-oblong, ca. 2.5 mm long, with small obtuse conical sessile appendage. May.

- 447 River valleys among riparian woodland, irrigation ditches and fallow fields on loess-clayey soil, taluses and rocky places in foothills. — Centr. Asia: Ar.-Casp. (Aral Sea and Syr Darya in the south), Balkh. (S.), T. Sh., Syr D. Endemic. Described from Chirchik River valley near Karabash, environs of Tashkent. Type in Leningrad.

116. *E. zhiguliensis* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 64. — *Tithymalus zhiguliensis* Prokh. comb. nova, nomen altern. — *Galarhoeus zhiguliensis* Prokh. l. c. olim. — Ic.: Prokh. l. c. tabl. 11.

Perennial plants, (15)22–40(50) cm high, glabrous, glaucescent; root almost cordlike, horizontal or obliquely descending; stems solitary or only few, sometimes together with sterile ones, generally ascending at base, erect, (13)18–35(47) cm high, (0.51)1–2(2.5) mm thick, naked below, sparingly leafy above, simple (very rarely with short sterile branches), but with 1–4(8) axillary peduncles 1.3–6.8 cm long, sometimes absent; cauline leaves 5–20 (excluding the upper), hardly petiolate, short-cuneate or more or less rounded at base, linear or oblong-linear or sometimes linear-oblong-linear, 1.5–3.5(5) cm long, 2–4(6) mm wide, obtuse, sometimes hardly cuspidate, subentire, incurved at margin, 1-nerved, leaves on sterile shoots distinctly petioled, long-cuneate at base, narrowly oblong-linear or linear-spatulate, (1.8)2.5–5 cm long, (2)3–6 mm wide, rounded at apex. Terminal peduncles

4–8 (usually 5), (0.2)1.5–5.8 cm long, like axillary peduncles simple or bifurcate at summit; leaves of involucre like upper cauline leaves sessile, generally slightly auriculate-dilated at base, linear or linear-lanceolate or oblong, rarely rhombic-ovate, 0.7–2.8(3.5) cm long, 1.5–4(8) mm wide, mostly less than $2\frac{1}{2}$ (rarely up to $3\frac{1}{2}$) times and usually only $1\frac{1}{2}$ times shorter than adjacent peduncles, obtuse or more or less cuspidate; leaves of involucels 2, triangular- or orbicular-reniform or sometimes ovate-rhombic, (4)5–12(18) mm long, (5)7–17 mm wide, obtuse or more or less cuspidate, usually not overlapping; cyathium campanulate, 1.5–2.5 mm long, 1–2 mm in diameter, glabrous outside, lobes ovate or triangular, obtuse or truncate, ciliate; nectaries crescent-shaped, bicornute, with subulate horns longer than width of nectary; styles 1.5–2.5 mm long, nearly half-connate, bifid; schizocarp ovoid, obtuse, 3–3.5 mm long, trisulcate, cocci orbicular, glabrous, rugulose-tuberculate at dorsal side; seeds ovate, 2.2–2.5 mm long, smooth, brown, with convex disciform appendage. Fl. second half of May – first half of July, Fr. second half of June – July.

48 Cliffs, rocks, stony steppes, shrubby formations, open forests. – European part: V.-Don (Zhiguli and possibly near Khvalynsk in the east), Transv. ? (possibly at the basin of Sok River in the west). Endemic. Described from Shelekhmet' on Samara Bend. Type in Kuibyshev, cotype in Leningrad.

117. *E. subcordata* C.A.M. ex Ldb. Ic. pl. Fl. Ross. II (1830) 25; Fl. alt. IV, 184; Fl. Ross. III, 577; Boiss. in DC. Prodr. XV, 161; Korsh. Tent. Fl. Ross. or. 378; Prokh. in Izv. Akad. Nauk SSSR (1927) 211; Kryl., Fl. Zap. Sib. VIII, 1879. – *E. caesia* Kar. et Kir. in Bull. Soc. Nat. Mosc. XIV (1841) 743; Ldb. Fl. Ross. III, 576; Korsh. l. c. 377. – *E. eriophylla* Kar. et Kir. l. c. 744. – *E. Esula* var. *cyparissoides* Boiss. l. c. 161, p. p.; Prokh. in Izv. Akad. Nauk SSSR (1927) 211. – *Tithymalus subcordatus* (Ldb.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 88, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 178. – *Galarhoeus subcordatus* Prokh. in Tr. Kuibyshev. Bot. Sada, I (1941) 60, olim. – Ic.: Ldb. Ic. pl. Fl. Ross. tab. 186; Prokh., Obz. moloch. tabl. 61.

Perennial plants, glabrous or (var. *eriophylla*) more or less pubescent, glaucescent; root thin, creeping or obliquely descending; stems few or many, erect or ascending, 8–45 cm high, 1.5–2.5 mm thick below, with (2)4–11 axillary peduncles (0.8)1.5–5.5 cm long above, simple or rarely with short sterile branches at the lower part; basal leaves squamiform, ovate-lanceolate, brown; cauline leaves subsessile, slightly cordate or short-cuneate at base, linear or triangular-lanceolate or oblong, 1.2–4(5.5) cm long, (2)3–8(10) mm wide, more or less dilated, auriculate-below, obtuse or short-cuspidate, entire, thick, slightly shiny, 1-nerved, leaves on sterile branches linear-lanceolate or narrowly linear, 8–35 mm long, 0.5–4 mm wide. Terminal peduncles 5–10, 0.7–2.5 cm long, like axillary peduncles forked for 1–2 times; leaves of involucre auriculate-dilated at base, linear-lanceolate or ovate-oblong or rhombic-ovate, 7–25 mm long, (1)2–7 mm wide, acute or obtuse; leaves of involucels 2, reniform or rhombic-ovate, 5–12(18) mm long, 6–15 mm wide, acuminate or rarely obtuse; cyathium broadly campanulate, 1.5–2.5 mm in diameter,

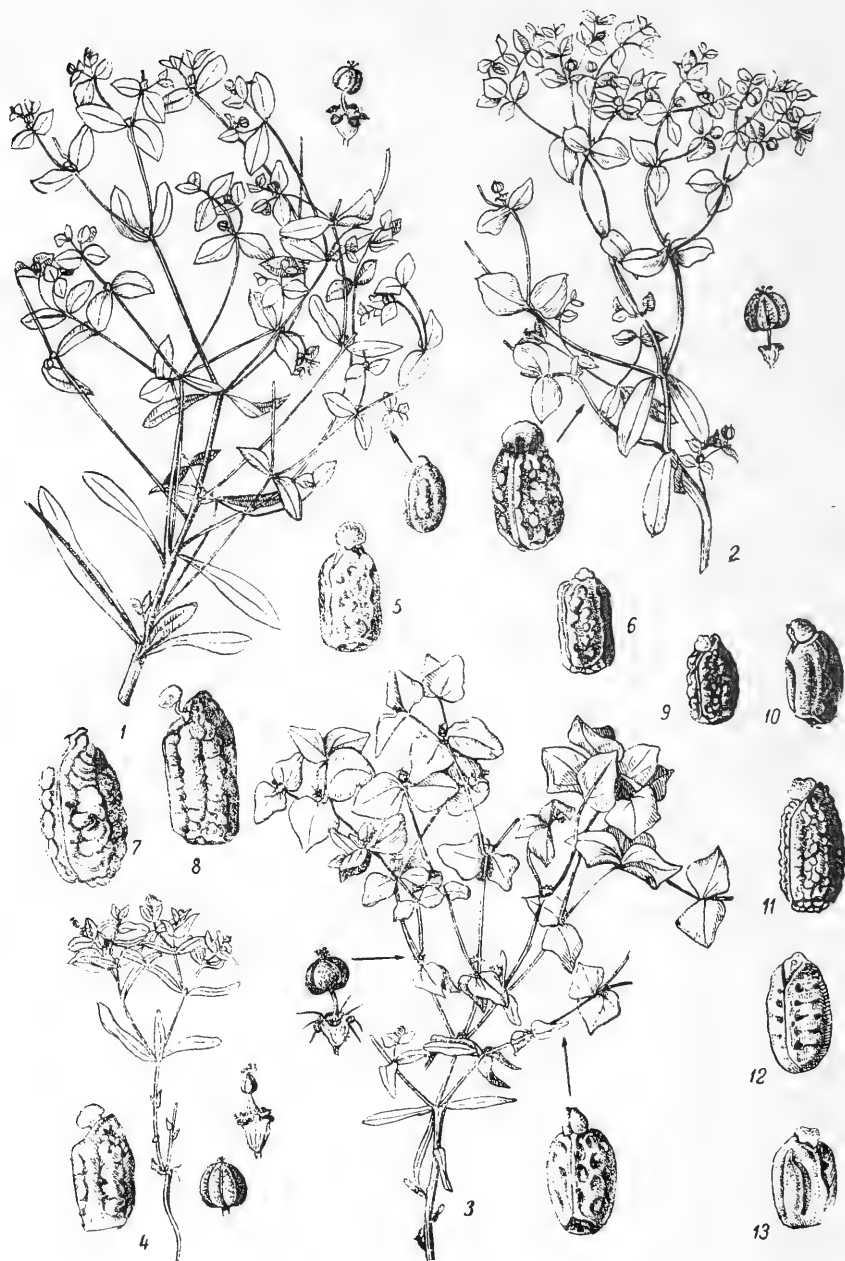


PLATE XXIII. 1—*Euphorbia normanni* Schmalh.; 2—*E. arvalis* Boiss. et Heldr.; 3—*E. graeca* Boiss. et Sprun.; 4—*E. aserbajdzhanica* Bord.; 5—*E. densa* Schrenk.; 6—*E. szovitsii* Fisch. et Mey.; 7—*E. consanguinea* Schrenk.; 8—*E. sororia* Schrenk.; 9—*E. exigua* L.; 10—*E. peplus* L.; 11—*E. francheti* B. Fedtsch.; 12—*E. falcata* L.; 13—*E. aulacosperma* Boiss.

51 glabrous outside, with small orbicular obtuse pubescent lobes; nectaries brownish-yellow, crescent-shaped, bicornute, with subulate horns as long as width of nectary or slightly longer; styles 1.5–2.5 mm long, half-connate, 2-lobed; schizocarp flattened-ovoid, 3–4(5) mm long, (3)3.5–5 mm thick, trisulcate, cocci orbicular, dorsally rugulose-tuberculate, at first pubescent, later glabrous; seeds oblong, 2.5(3.5) mm long, grayish-brown, smooth, with small convex disciform sessile appendage. (April) May, Fl. June.

Stony slopes in steppes, crests of hills. — European part: Transv. (N.); W. Siberia: U. Tob., Irt., Alt.; Centr. Asia: Balkh. (E.). Endemic? Described from Dolon-Kara Mountains beyond Kurchum River. Type in Leningrad.

Subsection 2. *SIEBOLDIANAE* Prokh. subsect. nova in Addenda XIII, 743. — See page 350 of the Key for characteristics of the subsection. Type of subsection: *Euphorbia stieboldiana* Morr. et Decne.

The species of the subsection are confined to the forests of East Asia, which might be an evidence of the Tertiary age of the group.

118. *E. sieboldiana* Morr. et Decne. in Bull. Acad. Brux. (1836) 174; Boiss. in DC. Prodr. XV, 2, 158, p. p. typ.; Sugawara, Ill. Fl. Saghalien, 1255. — *Tithymalus Sieboldianus* (Morr. et Decne.) Prokh. comb. nova, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 104; Sugawara, l. c. 1254, tab. 577.

Perennial glabrous plants, 22–55 cm high; rhizome horizontal, moniliform; stems single or few, erect, 19–50 cm long, 2–5 mm thick, simple, only rarely with 1–3 peduncles (5–10 mm long) above, sparsely leafy, with very large lower and sometimes upper internodes more than $\frac{1}{4}$ the length of adjacent leaves; cauline leaves 3–10, subsessile, cuneate at base, oblong or oblong-spatulate, (2.2)3–8.5 cm long, 8–22(28) mm wide, $2\frac{1}{2}$ to 4 times longer than wide, obtuse, entire, scarious, glaucescent beneath. Terminal peduncles 5(6), thin, spreading, (2)3–8 cm (in fruit up to 10 cm) long, bifurcate at summit, rarely simple; leaves of involucre sessile, oblong or rhombic-ovate, 2.2–4.2 cm long, (8)10–28 mm wide (2 to $3\frac{1}{2}$ times longer than wide), obtuse, 1-nerved; leaves of involucels 2, obliquely truncate or slightly cordate at base, oblong-deltoid or triangular-lanceolate, the lower 2.2–4.7 cm long, 1.5–3.3 cm wide (up to 2 times longer than wide), obtuse or subacute; cyathium campanulate, 2–2.5 mm long and broad, glabrous, with oblong slightly fimbriate lobes; nectaries dark, falcate, with horns 52 longer than width of nectary; styles 0.8–1.7 mm long, nearly free, bifid; schizocarp flattened-globulose, 3–3.5 mm long, 4.5–5 mm wide, deeply trisulcate, nearly smooth, glabrous; seeds compressed-ovate, 2.2–2.5 mm long, ca. 2 mm wide, smooth, dark brown, with small flattened appendage. Fl. April–May, Fr. May–June.

Forests and groves. — Far East: Sakh. (S.). Gen. distr.: Japan. Described from Japan. Type in Brussels.

Note. This species has a unique rhizome. By this character and also by its habit it resembles the European *E. dulcis* L., although no special affinity with the latter has been found.

The present description of the species was based on herbarium specimens from Japan.

119. *E. savaryi* Kiss. in Bot. Közl. XIX (1921) 91. — *E. Sieboldiana* auct.; Kom., Fl. Man'chzh. II (1904) 692, non Morren et Decne. (1836). — *Tithymalus Savaryi* (Kiss.) Prokh. comb. nova, nomen altern.

Perennial plants, 12–20 cm high at flowering and 20–50 cm in fruit, glabrous, often partly purplish; rhizome thin, creeping; stems few, erect, 2–3 mm thick, simple, sometimes with 1–4 axillary peduncles (1.5–5.5 cm long) above, scanty leafy, naked below; cauline leaves subsessile, tapering at base (the lower obovate), broadly oblong or oblong-spatulate, 1–2.8 cm long, 5–13(18) mm wide, obtuse or truncate, entire, scarious, glaucescent beneath, pinnately veined. Terminal peduncles 5, thin, spreading, unequal, 1–1.5 cm long at flowering, 4.5–8.5 cm in fruit, like axillary peduncles simple or often forked for 1–2 times; leaves of involucre oblong-rhombic or broadly ovate or obovate, 1.2–3 cm long, 6–17(19) mm wide (slightly or up to 2 times longer than wide), obtuse; leaves of involucels truncate or slightly cordate at base, triangular-reniform or triangular-ovate, 8–21 mm long, 11–30 mm wide, wider than long, obtuse or slightly acutish; cyathium campanulate, 2–2.5 mm long and broad, glabrous, with oblong, truncate, finely fimbriated lobes; nectaries 4, dark purple, falcate, with 2 subparallel horns longer than width of nectary; bracts of staminate flowers abortive; styles short, 0.7–1.2(1.5) mm long, nearly free, bifid; schizocarp flattened-globulose, ca. 3 mm long, 3.5–4 mm wide, deeply trisulcate, smooth, glabrous; seeds ovate, ca. 2.7 mm long, 1.7–1.8 mm wide, smooth, dark brown, with inconspicuous flattened appendage. Fl. May, Fr. June.

Mountain forests. Far East: Uss. (S.). Gen. distr.: Manchuria. Described from Voroshilov (formerly Nikolsk-Ussuriiskii). Type in Budapest?

453 Note. In habit this species is rather like *E. angulata* Jacq., although in fact it is far removed from it.

Subsection 3. PATELLARES Prokh. subsect. nova in Addenda XIII, 743. — See page 250 of the Key for characteristics of the subsection. Type of subsection: *Euphorbia amygdaloides* L.

Species of this subsection inhabit forests and subalpine meadows. *E. amygdaloides* is common in the southern forests of the Soviet Union and is a Tertiary relict; the other three species are typical for the Caucasus where they are endemic or extend only to Asia Minor. It is apparent that the Caucasus was the center of species formation of the subsection.

120. *E. amygdaloides* L. Sp. pl. (1753) 463; M. B. Fl. taur.-cauc. I, 372, III, 324; Ldb. Fl. Ross. III, 573; Boiss. in DC. Prodr. XV, 2, 170; Fl. or. IV, 1130; Hegi, Ill. Fl. V, 1, 164. — *E. sylvatica* L. l. c.; Jacq. Fl. austr. IV, 39. — *E. micans* Scheele in Linnaea, XVII (1843) 343. — *Tithymalus amygdaloides* (L.) Garsault, Descr. pl. et anim. (1764) tab. 594, Descr. Pl. Anim. (1767) 346; Thell. in Bull. Herb. Boiss. ser. 2, VIII, 107. — Ic.: Jacq. ("E. sylvatica") l. c. tab. 375; Engl. Bot. tab. 256; Rchb. Ic. Fl. Germ. V, tab. 150, f. 4799; Hegi, Ill. Fl. V, 1, tab. 178, f. 3 et f. 1774. — Exs.: Fl. Stir. exs. No. 457.

Perennial plants, (20)30–70 cm high; root horizontally creeping, woody, branching, multicapital; stems many, erect or ascending, becoming woody, densely leafy, at first sterile, with overwintering terminal rosette, then below and at the middle already naked, covered with scars, contorted, the fertile stems growing from top of the overwintering stems, rounded, striate, rarely leafy, glabrous or with rufous-brown pubescence, above with 4–9 axillary peduncles 2–5.5 cm long (in fruit 4.5–10 cm); leaves of sterile stems with 5–10 mm long petioles, tapering at base, oblong-obovate or obovate, (2.5)3.5–7(12.5) cm long, (8)15–30(40) mm wide, entire, tapering at apex, acute or obtuse, thin but flexible, dark green, later subcoriaceous and more or less cartilaginous; leaves of fertile stems sessile, oblanceolate or obovate, 8–25 mm long, 5–13 mm wide (sometimes nearly squamiform), entire, rounded or obtuse at apex, soft, yellowish-green, glabrous or pubescent. Terminal peduncles 5(6), 1.5–5.5 cm long (in fruit up to 7 cm), like axillary peduncles twice forked; leaves of involucre small, orbicular-obovate or ovate, (8)10–20 mm long, 7–13 mm wide, obtuse or slightly emarginate or somewhat acuminate; leaves of involucels sub-orbicular-reniform, 7–14 mm long, 13–23(27) mm wide (1½ to 2 times wider than long), coalescent in pairs for more than half the length into orbicular slightly concave blade, yellowish-green; cyathium campanulate, 2.5–3 mm long and broad, hairy inside, with ovate dentate lobes; nectaries 4, yellow or purple, bicornute, with converging acute horns only a little longer than width of nectary; styles 1.5–2 mm long, nearly free, deeply bifid; schizocarp flattened-ovoid, 3–3.5 mm long, 3.5–4.5 mm wide, deeply trisulcate, glabrous, finely dotted, scabrous; seeds ovate-orbicular, 1.7–2.5 mm long, smooth, bluish-gray, with small slightly keeled, later subrostriform appendage. April (in the Crimea)–first half of May.

Broadleaved forest edges, shrubby formations, grass plots, hedges, up to foothills, especially in limestone soil. — European part: U. Dns., M. Dnp. (W.), Bes., Crim.; Caucasus: W. and E. (only Kuba district) Transc., Tal. Gen. distr.: Centr. and Atl. Eur., W. Med. (except for N. Africa), Bal.-As. Min., Iran. (N.), introduced into N. Am. Described from W. Europe. Type in London.

121. *E. glaberrima* C. Koch in Linnaea, XXI (1848) 726, non Klotzsch (1852–57). — *E. iteophylla* Boiss. Cent. Euph. (1860) 39, in DC. Prodr. XV, 2, 171; Fl. or. IV, 1131. — *Tithymalus glaberrimus* (C. Koch) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 95, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 113.

Perennial plants, (25)35–80 cm high, glabrous, glaucous-yellow, rarely slightly reddening; stems erect, sulcate-striate, becoming slightly woody at base, 4–9 mm thick, the fertile ones densely leafy below at first but soon becoming naked, but with leaf scars, less densely leafy above, with (8)11–40 axillary peduncles (1.5)3–6(9) cm long, without sterile branches, often rhizome producing also shorter sterile stems, densely leafy at apex; cauline leaves scarious, entire, leaves on sterile stems and the lower on fertile stems approximate, sessile, tapering at base, oblanceolate, 5–13.3 cm long, 1–3.2 cm wide, acute, sometimes absent, leaves on fertile stems gradually becoming smaller upward, more or less cordate at base, oblong, (1.5)3–6 cm long, (7)12–25 mm wide, obtuse. Terminal peduncles (6)7–10(13),

1–4.5(6) cm long, like axillary peduncles forked for 1–2(3) times; leaves of involucre oblong-ovate or orbicular-ovate, 1.3–2(2.5) cm long, 7–14 mm wide, obtuse; leaves of involucels suborbicular, obtuse, coalescent in pairs for more than half the length into small orbicular blade, the lower 8–15 mm long, 14–22 mm wide; cyathium campanulate, 2.5–3 mm long and broad, with ovate ciliate lobes; nectaries 4, with converging acute horns 1–1.5 mm long; styles 1–1.5 mm long, connate at base, deeply bifid; schizocarp flattened-ovoid, 3.5–4.5 mm long, 3.5–5 mm wide, deeply trisulcate, with
455 orbicular cocci, tuberculate-punctate; seeds ovate, 2.2–2.8 mm long, 1.8–2 mm wide, smooth, grayish-black, with sessile flattened appendage. Second half of April–July.

Subalpine meadows and in mountainous forests, especially beech and birch, often among rhododendrons, 800–2,800 m elevation. — Caucasus: Dag., W. and E. Transc. Endemic. Described from the banks of the Borchalo in Kura valley. Cotype in Leningrad.

122. *E. oblongifolia* C. Koch in Linnaea, XXI (1848) 726. — *E. amygdaloides* β . *oblongifolia* C. Koch in Linnaea, XIX (1847) 17. — *E. rumicifolia* Boiss. Cent. Euph. (1860) 39; in DC. Prodr. XV, 2, 171; Fl. or. IV, 1131. — *Tithymalus oblongifolius* (C. Koch) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 96, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 115. — Exs.: Fl. cauc. exs. No. 95, G. R. F. No. 2587.

Perennial plants, (20)30–70 cm high, with leaves more or less hairy beneath or rarely nearly glabrous; stems erect, sulcate-striate, not becoming woody below, 5–7 mm thick, usually glabrous, leafy, above with 6–16 axillary peduncles (1.2)–4(6) cm long, without sterile branches; cauline leaves (except for the upper) short-petiolate (petioles 2–5 mm long), obtusely cordate at base, oblong, 3–7.5(9.3) cm long, 1.5–3(3.5) cm wide, obtuse, entire, slightly undulate at margin, scarious, more or less pubescent at lower side especially near petioles. Terminal peduncles 5–8, 0.8–3.5 cm long, like axillary peduncles forked for 1–2 times; leaves of involucre truncate at base, oblong, 1.5–3.2(3.7) cm long, 9–16 mm wide, acuminate; leaves of involucels suborbicular, obtuse, connate in pairs for approximately $\frac{2}{3}$ of the length into orbicular, slightly concave blade, the lower 7–18 mm long, 12–27 mm wide; cyathium broadly campanulate, 2–2.5 mm long, 2.5–3 mm in diameter, tomentose inside, with short-ovate, truncate, densely ciliate lobes; nectaries 4, falcate, wide, with converging horns 1–1.5 (rarely 2) mm long; styles 1–1.5 mm long, thickish, connate at base, 2-lobed; schizocarp flattened-ovoid, deeply trisulcate, with orbicular, tuberculate-punctate cocci; seeds ovate-orbicular, 2.5–2.8 mm long, 1.8–2.2 mm wide, smooth, grayish-black, with small flat appendage.

Mountain forests and subalpine meadows. — Caucasus: W. Transc., Tal. Gen. distr.: As. Min. Described from Asia Minor, near Brussa. Type in Berlin.

123. *E. macroceras* Fisch. et Mey. Ind. sem. hort. Petrop. IV (1837) 86; Ldb. Fl. Ross. III, 572; Boiss. in DC. Prodr. XV, 2, 171; Fl. or. IV, 1131. — *Tithymalus macroceras* (Fisch. et Mey.) Kl. et Gke.
456 ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 35, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 114. — Exs.: Pl. or. exs. No. 162.

Perennial plants, (60)80–90 cm high, sparingly spreading-hairy throughout; root creeping; stems herbaceous, 5–6 mm thick below, sulcate-striate, above with 5–11 axillary peduncles 5–12 cm, rarely 14 cm long, without sterile branches; cauline leaves with 1–1.5 cm long petioles, cuneate at base, ovate-oblong, 6–14 cm long, 2.5–4.5(5.5) cm wide (the uppermost gradually smaller), acute, entire, thin and scarious. Terminal peduncles 5, 4.5–10 cm, rarely 12 cm long, like axillary peduncles 1–2(3) times forked into elongated branches; leaves of involucre elliptic or oblong-obovate, 3–7.5 cm long, 1.2–3.5 cm wide; leaves of involucels 2, falcate, obtuse, connate in pairs (ca. $\frac{3}{4}$ of their length), into slightly concave orbicular blade, the lower (1)1.5–3.5 cm long, (1.8)2.2–4.8 cm wide; cyathium subglobular-campanulate, 2.5–3 mm long and broad, lanate at throat, lobes short-ovate, obtuse-truncate, densely ciliate; nectaries 4, horns gradually acuminate, curved, converging, 2–3 mm long (i. e., longer than width of nectary); styles 1.5–2.5 mm long, connate only at base, deeply bifid; schizocarp flattened-ovoid, 3.5–4.5 mm long, 4–5.5 mm wide, deeply trisulcate; tuberculate-punctate; seeds ovate-globular, 2.6–2.7 mm long, 1.9–2 mm wide, smooth, greenish-black, with sessile flattened appendage. Second half of June – first half of July.

Mountain forests. – Caucasus: Dag.? W. Transc., E. Transc. (Kartalinia, Borzhomi district, vicinity of Kirovabad). Endemic. Described from Kartalinia. Type in Leningrad.

Note. *E. macroceras* is a comparatively rare species; its distribution in the Caucasus is in the west and possibly in the southern part of E. Transcaucasia and in Dagestan.

The numerous reports on this species are due to its being confused with *E. oblongifolia* C. Koch., which is very close but more widely distributed.

Section 7. HERPETORRHIZA Prokh. sect. comb. nova. – Gen. *Tithymali* sect. *Herpetorrhiza* Prokh., Obz. moloch. Sr. Azii (1933) 142. – See page 247 of the Key for characteristics of this section. Type of section: *Euphorbia polytimitica* Prokh.

The section is distributed in the mountains of Southwest Asia and the Himalayas.

Note. Apparently the morphological origin for the following annuals of section *Cymatospermum*.

124. *E. aucheri* Boiss. Diagn. ser. 1, VII (1846) 94; Fl. or. IV, 1122. – *E. bounophila* var. *Aucheri* Boiss. in DC. Prodr. XV, 2 (1862) 154. – *Tithymalus Aucheri* (Boiss.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 93. – *T. Litwinowii* Prokh., Obz. moloch. Sr. Azii (1933) 147. – *T. herpetorrhizus* Prokh. l. c. 145. – Ic.: Prokh. l. c. tabl. 48 ("T. Litwinowii") tabl. 47 ("T. herpetorrhizus").

Perennial plants, 4–25 cm high, glabrous, glaucous or grayish-glaucous, sometimes more or less reddish above; root creeping or obliquely descending, multicapital; stems many, ascending and rarely slightly flexuous at base, spreading or more or less erect, 3–20 cm high, sometimes becoming red, branching below, simple above, only with 1–3 axillary peduncles

1.5–3.5 cm long, rather densely leafy in the lower part, usually with strongly elongated (2–5 cm) upper internodes; cauline leaves subsessile, rounded or attenuate at base, oblong-obovate or orbicular-elliptic or rarely linear-oblong, 4–11 mm long, 2–5 mm wide, obtuse or truncate, sometimes abruptly short-cuspidate, slightly cartilaginous at margin, subentire, more or less thick, sometimes reddish, inconspicuously nerved. Terminal peduncles 4–5(6), varying in length, (1)2–5 cm long, like axillary peduncles bifurcate at summit, rarely with only 1 secondary peduncle; leaves of involucre subsessile, somewhat attenuate at base, orbicular-ovate or elliptic or rhombic-ovate, 5–10 mm long, 3–7 mm wide, obtuse or short-cuspidate, sessile; leaves of involucels 2, subsessile, rhombic-ovate or orbicular or rarely triangular-reniform, 4–6(10) mm long, 5–7(11) mm wide, obtuse, sometimes hardly cuspidate, narrowly cartilaginous at margin, subentire or sometimes crenulate, sometimes slightly reddish; cyathium campanulate, 1.5–2 mm long and broad, glabrous, with small ovate ciliate lobes; nectaries more or less dark, transversely oblong (0.8–1 mm wide), obtuse-truncate at margin, bicornute, with pale subulate horns, a little longer than width of nectary; styles 1–1.3 mm long, nearly free, bifid; schizocarp ovoid, truncate, 3.5–4 mm long, trisulcate, with smooth orbicular cocci, sometimes slightly reddening; seeds hexahedral, slightly tuberculate-rugose at surface. Fl. May—first half of June, Fr. June.

Mountain slopes and taluses, up to 2,300 m. — Centr. Asia: Mtn. Turkm. Gen. distr.: Iran. (N.). Described from N. Iran, from Elamout Mountain. Type in Geneva.

125. *E. deltobracteata* Prokh., Obz. moloch. Sr. Azii (1933) 149. — *Tithymalus deltobracteatus* Prokh. ibid. nomen altern. — Ic.: Prokh. l. c. tabl. 49.

458 Perennial caespitose plants, 8–16(23) cm high, glabrous, pale green; root descending, multicapital; stems many, erect, 5–15(21) cm high, thin, becoming woody at base, usually not reddish, simple, sometimes with 1 axillary peduncle above; basal leaves squamiform, oblong, persistent; cauline leaves rather dense, with internodes usually shorter than $\frac{1}{2}$ the leaf, subsessile, somewhat attenuate at base, linear-oblong or oblong-lanceolate, 6–21 mm long, 1.5–2.5(8) mm wide, obtuse or slightly cuspidate, usually finely serrate, with 1 inconspicuous nerve. Terminal peduncles 5, 0.3–2(4) cm long, simple or rarely bifurcate at summit; leaves of involucre sessile, more or less dilated and rounded at base, elliptic-lanceolate or rarely rhombic-lanceolate, 8–17 mm long, 2–9 mm wide, acute, finely serrate; leaves of involucels 2, triangular-ovate or rhombic deltoid, 5–10 mm long, 4–10 mm wide, more or less cuspidate, crenate; cyathium campanulate outside, 2.5–3 mm in diameter, villous inside, with orbicular ciliate lobes; nectaries dark, broadly crescent-shaped, bicornute, with subulate horns as long as width of nectary or slightly longer; styles 1.5–2 mm long, connate at base, bifid for $\frac{1}{3}$; schizocarp ovoid, truncate, 3–3.5 mm long, trisulcate, with orbicular smooth cocci; seeds oblong, ca. 2.5 mm long, somewhat hexahedral, with concave faces, faintly and sparingly tuberculate, with oblique flattened-conical sessile appendage. Second half of April—first half of May.

Steppe grassy slopes, soft chestnut soil. — Centr. Asia: Mtn. Turkm. (W.). Endemic? Described from W. Kopet Dag, Khosar Mountain. Type in Leningrad.

126. *E. polytimetica* Prokh., *Obz. moloch. Sr. Azii* (1933) 142. — *E. prorepens* M. Pop., *Rast. zap. Guralash* (1936) 32. — *Tithymalus polytimeticus* Prokh. l. c. nomen altern. — Ic.: Prokh. l. c. tabl. 46.

Perennial plants, 5–18 cm long, glabrous, glaucous; root long, creeping, flexuose, woody; stems many, thin in the lower part, brittle, creeping, branching, spreading in the upper part, slightly flexuose, rarely leafy, above with axillary peduncles (0.5–1.5 cm long); cauline leaves alternate, short-petiolate, the upper gradually becoming larger, cuneate at base, obovate or rarely spatulate, 5–15 mm long, 3–10 mm wide, obtuse or truncate, sometimes emarginate, subentire, inconspicuously veined. Terminal peduncles 2–5, more or less flexuose, 0.6–2.5(4) cm long, like axillary peduncles once or sometimes twice forked; leaves of involucre orbicular, obovate or flabelliform or rarely reniform, 3–14(20) mm long, 5–13 mm wide, up to $1\frac{1}{2}$ times longer than wide or rarely wider than long; leaves of involu-
59 cels 2, orbicular-obovate or rhombic reniform, 3–15 mm long, 4–20 mm wide, obtuse, sometimes abruptly subcuspidate, cartilaginous at margin, incurved; cyathium campanulate, 1.5–2 mm long and broad, lobes triangular-ovate, white, slightly fimbriate; nectaries transversely oblong, (0.8–1 mm wide), obtuse-truncate, bicornute, with subulate horns, approximately $1\frac{1}{2}$ times longer than width of nectary; styles ca. 1 mm long, bifid; schizocarp ovoid, truncate, 3.5–4 mm long, ca. 4 mm wide, deeply trisulcate, cocci orbicular, glabrous; seeds oblong, 2.5–3 mm long, subhexahedral, with concave, longitudinally wrinkled and pitted-sulcate at faces, whitish, with oblique ovate-conical short-stalked appendage. Fl. June, Fr. July.

Rocks and taluses in the alpine belt (2,700–3,400 m elevation), often at edges of glaciers and even in snow. — Centr. Asia: Pam.-Al. (mountains along Zeravshan River and Gissar Range in the north). Endemic. Described from Kach-Kutal gorge in Gissar Range. Type in Leningrad.

Note. This species is closely related to, if not identical with, the Himalayan *E. kanaorica* Boiss. As long as there is no detailed morphological comparison of the two species, the specific independence of the Russian *E. polytimetica* Prokh. cannot be regarded as final.

Section 8. CYMATOSPERMUM Prokh. sect. comb. nova in Addenda XIII, 743. — Gen. *Tithymali* sect. *Cymatospermum* Prokh., *Obz. moloch. Sr. Azii* (1933) 151, ampl. — Gen. *Tithymali* sect. *Oppositifolium* Prokh. l. c. 122. — Gen. *Galarhoei* sect. *Oppositifolii* Prokh. in *Trud. Kuibysk. Bot. Sada*, I (1941) 34. — Subsection *Oppositifoliae* Boiss. in *DC. Prodr.* XV, 2 (1862) 99; Fl. or. IV, 1083, 1(91. — See page 321 of the Key for characteristics of this section. Type of section: *Euphorbia falcata* L.

Note. This section practically comprises all annual spurges with more or less bicornute nectaries. It is very possible that as such it is not a natural group and that in the future it will have to be revised.

Subsection 1. OLERACEAE Prokh. subsect. nova in Addenda XIII, 743.— Type of subsection: *Euphorbia peplus* L.

Cauline leaves and leaves of involucre usually cuneately tapering at base, rarely more or less auriculate-dilated; nectaries with elongate thin horns, rarely rather short; styles short or long; stems more or less many due to basal branching, often also with lateral leafy shoots.

Note. This subsection should be subdivided into natural groups; in its present state it includes various forms of different origins, which share a long growth period lasting many months.

- 460 127. *E. aleppica* L. Sp. pl. (1753) 458; Ldb. Fl. Ross. III, 570; Boiss. in DC. Prodr. XV, 2, 138; Fl. or. IV, 1109.— *E. condensata* Fisch. ex M. B. Fl. taur.-cauc. III (1819) 322.— *Tithymalus aleppicus* (L.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 84, nomen altern.— Ic.: Sibth. et Sm. Fl. Graeca, V, tab. 462; Rchb. Ic. Fl. Germ. V, tab. 142, f. 4781.— Exs.: Fl. exs. austro-hung. No. 45; Herb. Fl. Cauc. No. 334; Dörfler, Herb. Norm. No. 5171.

Annual plants, 12–30 cm high, glaucous, glabrous or farinaceous-scabrous; stems more or less numerous because of basal branching, ascending below then erect, (1.5)2–3.5 mm thick, very densely leafy, becoming naked, with numerous leaf scars, simple, usually without axillary peduncles; cauline leaves sessile, the lower setaceous, the upper narrowly linear, the upper gradually becoming wider, 1.2–2 cm long, 0.2–1.5 mm wide, cuspidate. Terminal peduncles 5, thick, spreading, 1–4.5 cm long, forked for many times; leaves of involucre lanceolate, 2–3.5 cm long, 2–4 mm wide, acute; leaves of involuclers sessile, oblique at base (often with 1 lateral auricle), ovate-rhombic, long-cuspidate, cusp 1–1.5 mm long, acutely dentate with unequal teeth, the lower 1.1–2.2 cm long, 0.7–1.3 cm wide; cyathium turbinate-campanulate, 1–1.5 mm long and broad, glabrous, slightly hairy inside, with small oblong fimbriate lobes; nectaries 4, crescent-shaped, wider than long (ca. 1 mm), with diverging subulate horns as long as width of nectary or $1\frac{1}{2}$ times longer; styles 0.8–1 mm long, connate at base, bifid for more than half the length; schizocarp flattened-ovoid, 2.5–3 mm long, 2–2.5 mm wide, deeply trisulcate, with keeled cocci; seeds ovate, orbicular-tetrahedral, 1.5–1.7 mm long, 1–1.2 mm wide, densely white-tuberculate, without appendage. June–August.

Mountain slopes, fallow fields and crops, roadsides and weedy places.— European part: Crim.; Caucasus: W., E. and S. Transc., Tal. Gen. distr.: E. Med., Bal.-As. Min., Arm.-Kurd. Described from Aleppo in Syria and from Crete. Type in London.

128. *E. exigua* L. Sp. pl. (1753) 456; M. B. Fl. taur.-cauc. I, 371; Ldb. Fl. Ross. III, 569; Boiss. in DC. Prodr. XV, 2, 139; Fl. or. IV, 1110; Hegi, Ill. Fl. V, 1, 187.— *Tithymalus exiguus* (L.) Lam. Fl. Fr. III (1775) 100, nomen altern.— Ic.: Fl. Dan. 592; Engl. Bot. tab. 1336; Rchb. Ic. Fl. Germ. V, tab. 141, f. 4777; Hegi, Ill. Fl. V, 1, f. 1799.— Exs.: Fl. exs. austro-hung. No. 2851; G. R. F. No. 2583; Fl. pol. exs. No. 875.

Annual glabrous plants, 5–20(25) cm high; root thin, fusiform; stems often few or many due to basal branching, erect, ascending or decumbent, thin, rounded, yellow-green, sometimes reddish, densely leafy, usually branching, usually with 1–5 axillary peduncles (0.3–4 cm long) above, below often with numerous more or less developed leafy branches; cauline leaves strict, sessile, the lower smaller, obtuse, sometimes tridentate, generally opposite, the upper gradually becoming larger below, always alternate, acute, 0.6–2.3 cm long, 0.5–1.5 mm wide, yellow-green, scarious. Terminal peduncles 3 or 5 (rarely 4), 0.4–1.5 cm long, like axillary peduncles once or many times bifurcate; leaves of involucre more or less dilated, sometimes slightly cordate-auriculate at base, linear-lanceolate, 0.7–2 cm long, 1–2.5 mm wide, acute or obtuse; leaves of involucels sessile, dilated and often slightly cordate at base, broadly linear or triangular-lanceolate, 5–10 mm long, 1.5–2.5 mm wide, acute or obtuse or emarginate; cyathium turbinate, 0.6–0.8 mm long and wide, hairy at throat, with ovate dentate lobes; nectaries 4, yellow, crescent-shaped, wider than long, with diverging horns, a little shorter than width of nectary; styles 0.4–0.6 mm long, free, deeply bifid; schizocarp trihedral-ovoid, 1.8–2 mm long and wide, trisulcate, smooth or nearly so, glabrous, with orbicular cocci; seeds ovate, tetrahedral, 1.2–1.4 mm long, 0.9–1 mm wide, yellowish-white, later brown-black, finely tuberculate, with scattered white tubercles, and small sessile reniform appendage. May–November. (Plate XXIII, Figure 9.)

Clayey pastures, crops, waste land, roadsides, rubble, plains and foothills. — European part: Balt., U. Dnp., U. Dns., M. Dnp. (W.), V.-Don (only near Venev); Caucasus: W. Transc. (Novorossiisk). **Gen. distr.:** Scand. (S.), Centr. and Atl. Eur., W. Med. (E. Med.?), Bal.-As. Min. Described from crop fields in W. Europe. Type in London.

129. *E. graeca* Boiss. et Sprun. Diagn. ser. 1, IV (1844) 53; Boiss. in DC. Prodr. XV, 2, 144; Fl. or. IV, 1115; Lipskii in Tr. B. S. XIII, 333. — *E. retusa* auct.; M. B. Fl. taur.-cauc. I (1808) 371, non Cav. — *E. dalmatica* Vis. Fl. dalm. III (1852) 228. — *Tithymalus graecus* (Boiss. et Sprun.) Prokh. comb. nova, nomen altern. — Exs.: Fl. exs. austro-hung. No. 2847; Spruner, Boiss. et Heldr. fl. exs. No. 1894; Boiss. et Bal. exs. 1854, No. 347; G. R. F. No. 2577.

Annual plants, 8–30 cm high, glabrous, glaucescent; stems more or less many due to basal branching, rarely solitary, erect or ascending, usually without sterile branches, above with 1–4 axillary peduncles (2.5–5.5 cm long); cauline leaves narrowly oblanceolate or linear or linear-oblong, 0.8–3.4 cm long, 2–3 mm wide (the upper dilated up to 6 mm at base), obtuse or truncate. Terminal peduncles (3)4–5, 1.5–7.5 cm long, like axillary peduncles 2–3 times bifurcate; leaves of involucre (like upper cauline) sessile, dilated and subcordate at base, linear-lanceolate or oblong-lanceolate, 0.7–2.8(4.7) cm long, 2–6 mm wide; leaves of involucels cordate at base, triangular or triangular-lanceolate, (0.5)1–2.8(3.4) cm long, 5–10(13) mm wide, acute; cyathium campanulate, 1–1.5 mm long and broad, glabrous, with ovate fimbriate lobes; nectaries 4, crescent-shaped, with setaceous diverging horns twice as long as width of nectary; styles (0.9)1–1.3 mm long, free, bifid for more than half; schizocarp broadly ovoid, 2.2–2.5 mm long, 2.6–2.8 mm wide, deeply trisulcate, finely alveolate; seeds

ovate, netted-pitted, with conical, later sulcate, appendage. April – September. (Plate XXIII, Figure 3.)

Stony slopes of mountains and hills. – European part: Crim.; Caucasus: W. Transc. (NW). Gen. distr.: Centr. Eur. (C. Hungary), Bal.-As. Min. Described from Greece. Type in Geneva.

130. *E. ledebourii* Boiss. Cent. Euph. (1860) 35, et in DC. Prodr. XV, 2, 143; Fl. or. IV, 1113. – *E. pygmaea* auct.; Ldb. Fl. Ross. III, 569, p. p. non Fisch. et Mey. ex Boiss. nec. Philippi (1857–1858). – *Tithymalus Ledebourii* (Boiss.) Prokh. comb. nova, nomen altern. – Ic.: Boiss. Ic. Euph. tab. 95.

Annual glabrous plants, 10–20 cm high; stems solitary or often few from base, below usually ascending, above erect, robust, sometimes with 1 axillary peduncle above, simple below or with short leafy sterile lateral shoots; cauline leaves alternate, the lower linear-spatulate, generally obtuse, the others gradually becoming larger above, linear, 0.6–2.5 cm long, 1.5–2.5 mm wide, acuminate, entire. Terminal peduncles 3 (rarely 4 or 5), 1–2 times or even many times bifurcate; leaves of involucre linear, 2–4 cm long, 1–2 mm wide, acuminate; leaves of involucels 2, slightly dilated at base, narrowly linear, acuminate, the lower resembling the upper cauline, 1.5–2 cm long, 1–1.5 mm wide, the upper gradually becoming smaller; cyathium turbinate, 1–1.2 mm in diameter, with ovate lobes; nectaries 4, crescent-shaped, with slightly converging horns, approximately $1\frac{1}{2}$ (2) times as long as width of nectary; styles 0.5–0.7 mm long, nearly free, 2-lobed; schizocarp ovoid, 2.5–3 mm long and wide, with orbicular cocci, dorsally finely tuberculate (under magnification); seeds compressed-ovate, orbicular-tetrahedral, 2–2.5 mm long, 1.2–1.4 mm wide, netted-pitted, with unequal ovate often fusing pits and small conical appendage. 463 May–September.

Rocks and stony taluses. – European part: Crim. (near Sudak); Caucasus: E. Transc. (near Kirovabad and Shusha), S. Transc. (only near Artvin). Nearly endemic. Described from near Shusha in Transcaucasia. Type in Leningrad.

Note. *E. pygmaea* Ldb. could have been used as the prior name, instead of *E. ledebourii* Boiss. if it had not then been erroneously applied also to *E. inderiensis* Kar. et Kir. by Ledebour, who initially viewed it in a very broad sense.

131. *E. peplus* L. Sp. pl. (1753) 456; Ldb. Fl. Ross. III, 570; Boiss. in DC. Prodr. XV, 2, 141; Fl. or. IV, 1112; Hegi, Ill. Fl. V, 1, 186. – *E. hyrcana* Grossh. in Izv. Tifl. Bot. Sada, ser. 2, I (1920) 7. – *Tithymalus Peplus* (L.) Gaertn. Fruct. sem. pl. II (1791) 115, nomen altern. – *Galarhoeus Peplus* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 34, olim. – Ic.: Rchb. Ic. Fl. Germ. V, tab. 140, f. 4773; Hegi, Ill. Fl. V, 1, f. f. 1797, 1798. – Exs.: Fl. exs. austro-hung. No. 2850; G. R. F. No. 2585; Pl. Finl. exs. No. 801.

Annual glabrous plants, 10–25 cm high; root thin; stems more or less many due to basal branching, ascending below, erect above, usually a little more than $\frac{1}{2}$ the height of the whole plant, branching, with above or without 1–4 axillary peduncles (2–4.5 cm long), often with sterile lateral shoots

below, sometimes simple; cauline leaves with 1–6 mm long petioles, cuneate at base, broadly obovate, 7–25 mm long, 5–16 mm wide, obtuse, entire, scarious. Terminal peduncles 3 (2–3 cm long), like axillary peduncles 2–5 times bifurcate; leaves of involucre with petioles up to 3 mm long, broadly obovate, 12–27 mm long, 7–14 mm wide; leaves of involucels 2, short-petiolate, oblique at base, ovate or triangular-rhombic, 10–17 mm long, 7–12 mm wide (the terminal reduced), obtuse or short-cuspidate, entire; cyathium campanulate, 0.7–1 mm in diameter, glabrous, with inconspicuous ovate fimbriate lobes; nectaries 4, bicornute, with yellowish-white subulate horns, distinctly ($1\frac{1}{2}$ –2 times) longer than width of nectary; styles 0.1–0.2 mm long, deeply bifid; schizocarp flattened-globulose, 1.8–2.2 mm long, 2–2.5 mm wide, trisulcate, cocci smooth, keeled with 2 longitudinal narrow dorsal wings, glabrous; seeds ash-gray, ovate, 1.25–1.5 mm long, hexahedral, smooth and concave at both inner faces, with longitudinal furrow, dark pitted on other faces, the outer faces with 3–4 pits, the lateral usually with 3, with appendage at apex. May–November. (Plate XXIII, Figure 10.)

464 Weedy cultivated soils, fields, gardens, vegetable crops, sometimes dry slopes. — European part: Lad.-Ilm. (Leningrad), U. V., Balt., U. Dnp., U. Dns., M. Dnp. (W.), Bl., introduced into Transv. (Kuibyshev) and L. Don (Saratov); Caucasus: W. Transc. (rarely, only Ivanovka), Tal. Gen. distr.: Scand. (S.), Centr. and Atl. Eur., Med., Bal.-As. Min., introduced into Jap.-Ch. and N. Am. Described from gardens in Europe. Type in London.

132. *E. aulacosperma* Boiss. Diagn. ser. 1, XII (1853) 117; Boiss. in DC. Prodr. XV, 2, 140; Fl. or. IV, 1111; Lipskii in Tr. B. S. XIII, 331. — *Tithymalus aulacospermus* (Boiss.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 82, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 92.

Annual glabrous plants, 10–20 cm high; stems erect, 1–2 mm thick, often branching from base (sometimes only with 2 branches below), sometimes with 1–4 axillary peduncles above, 1.5–2.5 cm long; cauline leaves tapering at base, obovate or spatulate-oblong, 8–20 mm long, 4–8 mm wide, hardly dentate, obtuse or truncate, scarious. Terminal peduncles 3(4), 1–3 cm long, once or many times bifurcate; leaves of involucre oblong-obovate, 10–19 mm long, 6–8 mm wide; leaves of involucels obliquely ovate-triangular or obliquely triangular-rhombic, ca. 12 mm long, 7–8 mm wide, often wider than long, obtuse, sometimes subacute; cyathium turbinate, 1–1.5 mm long and wide, hairy inside, with ovate truncate ciliate lobes; nectaries 4, crescent-shaped, with horns 2 to 3 times longer than width of nectary; styles 0.5–0.7 mm long, free, bifid; schizocarp flattened-ovoid, ca. 2.2 mm long, 2 mm wide, deeply trisulcate; seeds ovate, hexahedral, ca. 1.2 mm long, 0.7–0.8 mm wide, truncate, longitudinally 6-furrowed, with 1 furrow at each face, finely scabrous, with flattened appendage. (Plate XXIII, Figure 13.)

Weeds. — Caucasus: W. Transc. (Novorossiisk). Gen. distr.: E. Med., As. Min. (SE). Described from cultivated areas in the vicinity of Jerusalem in Palestine. Type in Geneva.

133. *E. falcata* L. Sp. pl. (1753) 456; M. B. Fl. taur.-cauc. I, 370; Ldb. Fl. Ross. III, 570; Boiss. in DC. Prodr. XV, 2, 140; Fl. or. IV, 1111; Hegi, Ill. Fl. V, 1, 184; Krisht. in Fl. Yugo-Vost. V, 665. — *Tithymalus falcatus* (L.) Kl. et Gke. ex Garcke Fl. Deutschl. ed. 4 (1849) 292, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 151. — *Galarhoeus falcatus* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 35, olim. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 141, f. 4776; Hegi, Ill. Fl. V, 1, f. 1796; Prokh., Obz. moloch. tabl. 50. — Exs.: Fl. exs. austro-hung. No. 2848; G. R. F. Nos. 1341, 2584.

- 465 Perennial plants, 7–30 cm high, glabrous or slightly hairy above, glaucous; stems fairly numerous due to basal branching, rarely solitary, 5–20 cm high, usually strongly branching, above with axillary peduncles, below often with short sterile branches; cauline leaves alternate, short-petiolate, cuneate at base, 1–3 cm long, 2–7 mm wide, the lower oblong-spatulate, obtuse, truncate, or emarginate, the others oblanceolate, acute, all entire or denticulate, usually 3-nerved, coriaceous, long persistent. Terminal peduncles 3–5, like axillary peduncles forked for many times, at first short, often ciliate, later usually elongating, inflorescence broadening up to 30 cm; leaves of involucre and of lower involucels cuneate at base, oblong or lanceolate, 1.4–2.5 cm long, 3–9 mm wide, acuminate; leaves of involucels (except for the lower) more or less oblique at base, orbicular-ovate or ovate-rhombic, 5–18 mm long, 5–10 mm wide, long-acuminate, with ca. 1 mm long mucro, often falcately curved, serrulate; cyathium campanulate, 1–1.5 mm wide, glabrous outside, hairy inside, with oblong ciliate lobes; nectaries crescent-shaped, hornless or rarely shortly bicornute; styles 1–1.5 mm long, free, deeply bifid; schizocarp conical-ovoid, 2–3.5 mm long, faintly trisulcate, with smooth obtusely keeled cocci, glabrous; seed oblong, 1.5–2 mm long, compressed-tetrahedral, with 5–10 regularly transverse furrows at faces, grayish, with globular-conical white easily falling appendage. June–October. (Plate XXIII, Figure 12.)

Weeds in fields, crops (weed after harvest), roadsides. — European part: V.-Don (Syzran and Elkhovka near Khvalynsk), Transv. (S.), Bl., Crim., L. Don; Caucasus: Cisc., Dag., E. and S. Transc.; Centr. Asia: T. Sh., Syr D., Pam.-Al., Amy D., Mtn. Turkm. Gen. distr.: Centr. and Atl. Eur. (in the south), Med., Bal.-As. Min., Arm.-Kurd., Iran., Ind.-Him. (W.). Described from S. Europe. Type in London.

134. *E. acuminata* Lam. Encycl. Bot. II (1786) 427; M. B. Fl. taur.-cauc. I, 370, III, 322; Hegi, Ill. Fl. V, 1, 185. — *E. obscura* Loisel. in Desv. Journ. Bot. II (1809) 332. — *E. falcata* var. *minor* Koch, Syn. (1837) 731; Boiss. in DC. Prodr. XV, 2, 140. — *E. galilaea* Boiss. Diagn. ser. I (1853) 116. — *E. pseudograeca* Grossh. in Izv. Azerb. Fil. AN SSSR, 1941, No. 1, 42. — *Tithymalus acuminatus* (Lam.) Prokh. comb. nova, nomen altern. — Ic.: *E. obscura* Loisel, l. c. tab. 5, f. 2; Rchb. Ic. Fl. Germ. tab. 132, f. 4755; Hegi, Ill. Fl. V, 1, f. 1796. — Exs.: Fl. austro-hung. No. 2849.

- 466 Annual plants, 5–20 cm high, glabrous, bluish; stems generally few due to basal branching, erect or ascending, above with 1–7 axillary peduncles (1–5 cm long), sometimes with short sterile branches below; cauline leaves short-petiolate, recurved, tapering at base, oblong-oblanceolate, 1–2.5 cm

long, 3–7 mm wide, acute, thin-scarious. Terminal peduncles 3–4, 0.5–4.5 cm long, like axillary peduncles forked for many times, often with close nodes; leaves of involucre recurved, oblanceolate or oblong-linear, (1.1)1.3–2.5 cm long, 3–6 mm wide, widest above, acute and often mucronate; leaves of involuclers 2, rounded or cordate at base, obliquely rhombic-ovate, hardly cuspidate, the lower 8–20 mm long, 5–10 mm wide, with eroded cartilaginous margin, thin; cyathium campanulate, glabrous, with ovate lobes; nectaries transversely oblong, truncate at base, reddish or orange, with very short white horns 2–3 times shorter than width of nectary; styles ca. 1 mm long, free, bifid; schizocarp ovoid, ca. 2.5 mm long, deeply trisulcate, with orbicular glabrous smooth cocci; seeds ovate, up to 1 mm long, slightly tetrahedral, transversely pitted (two faces with 3 transverse pits at each, and 4 at the others). May–July.

Crops, roadsides. — Caucasus: E. Transc. Gen. distr.: Centr. Eur. (in the south), Med., Bal.-As. Min., Arm.-Kurd.? Described from S. Switzerland. Type in Paris.

135. *E. normanni* Schmalh. ex Lipsky in Zap. Kievsk. obshch. estestv. XI, 2 (1891) 57; Schmalh. in Ber. Deutsch. Bot. Ges. X (1892) 293. — *Tithymalus Normanni* (Schmalh. ex Lipsky) Prokh. comb. nova, nomen altern. — Ic.: Schmalh. l. c. tab. XVI, f. 15. (seeds).

Annual plants, 10–20 cm high, glabrous, more or less glaucous; stem erect or ascending, more or less spreading-branching, above with 5–7 axillary peduncles (1.5)2–5.5 cm long, below usually with short sterile lateral shoots; leaves long-cuneate at base, narrowly oblanceolate or oblong-spatulate, 2.5–3 cm long, 4–5 mm wide, obtuse or short-cuspidate, denticulate at margin, 3-nerved. Cymose umbel loose; terminal peduncles 3–4, 1.5–4 cm long, like axillary peduncles forked for 2–3 times; leaves of involucre narrowly oblanceolate, 1.7–2.4 cm long, 3–5 mm wide, obtuse, 3-nerved; leaves of involuclers obliquely ovate or obliquely oblong, 1.1–1.5 cm long, (4)5–6 mm wide, falcate, cuspidate; cyathium turbinate, ca. 1 mm long and wide, with small oblong lobes; nectaries 4, transversely oblong, truncate, obscurely bicornute, with short acute horns; styles 0.8–1 mm long, bifid; schizocarp ovoid, truncate, 2–2.2 mm long, 1.8–2 mm wide, slightly trisulcate, with weakly keeled lobes; seeds grayish-white, ovate, 1.1–1.3 mm long, 0.7–0.9 mm wide, not compressed, tetrahedral, furrowed with 2 rows of irregular pits at each face, often confluent into 2 longitudinal furrows, appendageless. May–June. (Plate XXIII, Figure 1.)

Mountain slopes. — Caucasus: Cisc. (Stavropol, Nevinnomyssk, Temnollesskaya). Endemic. Described from Stavropol. Type in Kiev.

Note. A rather rare species, closely related to the common *E. falcata* L. from which it is easily distinguished by the seeds with two rows of pits at each face and not one.

136. *E. francheti* B. Fedtsch. in O. and B. Fedch., Perech. r. Turkest. VI (1916) 310. — *E. turkestanica* Franch. in Ann. Sc. Nat. ser. 6, XVIII (1884) 248, non Rgl., 1882. — *E. consanguinea* auct.; Boiss. in DC. Prodr. XV, 2 (1862) 100, p. p. non Schrenk. — *Tithymalus Francheti* (B. Fedtsch.) Prokh., Obz. moloch. Sr. Azii (1933) 140, nomen altern. — Ic.: Prokh. l. c. tabl. 45.

Annual plants, 9–20(30) cm high, glabrous, pale green; root thin, vertical; stems usually solitary, erect, 5–15(25) cm high, thin, sometimes with 1–4 axillary peduncles (up to 3 cm long) in upper part, usually without

sterile branches; cauline leaves alternate, short-petiolate, cuneate at base, oblanceolate or elliptic-oblanceolate, 7–25(30) mm long, 3–7 mm wide, the lower spatulate, obtuse, the upper often abruptly subcuspidate, all leaves entire or serrulate above, scarious, usually 3-nerved, deciduous. Inflorescence small at first; terminal peduncles 2 or rarely 3, like axillary peduncles bifurcate for many times, with long lower peduncles; leaves of involucre 3, oblanceolate, 10–27 mm long, 3–5 mm wide; leaves of involucels 2, cuneate or rounded at base, linear-oblong or rarely linear-oblanceolate, 5–20(25) mm long, 1–4(8) mm wide, obtuse or short-cuspidate; cyathium campanulate, ca. 1.5 mm in diameter, with oblong ciliate lobes; nectaries reddish, transversely oblong, bicornute, with whitish short-subulate horns; styles 0.6–0.8 mm long, free, deeply bifid; schizocarp ovoid, truncate, 2–2.5 mm long and wide, trisulcate, with smooth (hardly punctate) obtusely keeled cocci; seeds ovate, 1.7–2 mm long, longitudinally tuberculate-ribbed, appearing hexahedral due to accessory longitudinal tuberculate ribs at outer faces, truncate at base, with inconspicuous flat sessile whitish appendage at apex. May–July. (Plate XXIII, Figure 11.)

- 468 Stony and pebbly slopes, often shaly slopes, also on loesslike loams. —
 Centr. Asia: Balkh., T. Sh., Pam.-Al., Mtn. Turkm. (only near Kurt-Su towards Gaudan). Endemic? Described from Tengikharam. Type in Paris.

Note. *E. francheti* B. Fedtsch. is, to a certain degree, a link between subsection Oleraceae and subsection Oppositifoliae. In the length of styles (0.6–0.8 mm) this species is intermediate between *E. falcata* L. (styles longer than 0.8 mm) of the first subsection and species included in the second (styles shorter than 0.7 mm). While the upper cauline leaves and involucral leaves resemble those of *E. falcata* and its allied species, the leaves of the involucel of *E. francheti* are sometimes like those of subsection Oppositifoliae. Furthermore, the stems of this species usually do not branch, thus corresponding to the latter subsection, yet their rather high stature and the rare branching make it possible to place it in subsection Oleraceae, as we are doing. The seeds of this species also display a transitional character.

Is not *E. francheti* B. Fedtsch. merely a hybrid species originating in Central Asia, hybrid between representatives of subsection Oleraceae intruding there, notably *E. falcata* L., and the aboriginal forms of subsection Oppositifoliae?

Subsection 2. OPPOSITIFOLIAE Boiss. in DC. Prodr. XV, 2 (1862) 99; Fl. or. IV, 1083, 1091. — Gen. Tithymali sect. Oppositifolium Prokh., Obz. moloch. Sr. Azii (1933) 122. — See page 258 of the Key for characteristics of the subsection. Type of subsection: *Euphorbia inderiensis* Kar. et Kir.

This subsection of dwarf annual spurge is common to the steppes and deserts of the Turan desert lowland and the Plateau of Iran. It is represented by typical ephemeris having only a single reduced stem and depressed lateral branches.

Accordingly, Boissier's name for this subsection — "Oppositifoliae" — cannot be termed as successful since it refers only to the always opposite leaves of the numerous involucels of the (especially here) broadly spreading, umbelliform inflorescence and does not take into account the proper cauline leaves on the reduced stem which are partly alternate (not in *E. lathyris* L. with its always opposite leaves).

137. *E. inderiensis* Less. ex Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 448; Ldb. Fl. Ross. III, 559. — *E. pygmaea* Fisch. et Mey. ex Boiss. in DC. Prodr. XV, 2 (1862) 99, non Ldb.; Boiss. Fl. or. IV, 1091; Prokh. in Izv. Akad. Nauk SSSR (1927) 197. — *Tithymalus inderiensis* (Less. ex Kar. et Kir.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 65, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 122. — *T. pygmaeus* Kl. et Gke. apud Klotzsch, l. c. 84. — Ic.: Boiss. Ic. Euph. tab. 51 ("*E. pygmaea*"); Prokh., Obz. moloch. tabl. 36.
- 469 Annual plants, 5–15(25) cm high, glabrous, glaucous; root thin, vertical; stems usually half the length of the plant, thin; cauline leaves (except cotyledons) usually alternate, sessile, narrowly linear, 1–2 cm long, 0.5–1.25 mm wide, acuminate, acute or often obtuse, entire, deciduous. Inflorescence spreading, loose; terminal peduncles 2 or rarely 3, bifurcate for many times; leaves of the numerous involuclers 2, similar in shape to the cauline but larger (up to 2.7 cm long) and persistent; cyathium narrowly campanulate, 0.7–1 mm in diameter, with ovate fimbriate lobes; nectaries greenish, crescent-shaped, usually bicornute, with short horns; styles (.4–0.5 mm long, free, slightly thickening above, bifid; schizocarp ovoid, truncate, 3–3.5 mm long, 2.5–3 mm wide, trisulcate, with obtusely keeled nearly smooth (hardly netted) cocci; seeds ash-gray, oblong, 1.2–1.5 mm long (up to 2 mm long with appendage), hexahedral, longitudinally and narrowly 1-furrowed along faces, transversely wrinkled-folded, obliquely truncate, with horizontal, scalelike, long-stalked appendage (on stalk ca. 0.5 mm long). April–June.
- Clayey steppes and mountain slopes with conglomerate outcrops. — Centr. Asia: Ar.-Casp., Balkh. (S.), Dzu.-Tarb., T. Sh., Syr D., Kyz. K., Pam.-Al., Amu D., Kar K., Mtn. Turkm. Gen. distr.: Dzhu.-Kash. (Kuldja District). Described from the sands of Dzungaria near Sassyk-Pastau spring. Type in Leningrad.
138. *E. triodonta* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 555. — *Tithymalus triodontus* Prokh. ibid. nomen altern.; Prokh., Obz. moloch. Sr. Azii, 125. — Ic.: Prokh., Obz. moloch. tabl. 37.
- Annual plants, 7–18 cm high, glabrous, glaucous; stems distinctly shorter than inflorescence; cauline leaves (except cotyledons) alternate, deciduous, inflorescence loose, spreading; terminal peduncles 2, bifurcate for many times; leaves of the numerous involuclers 2 of each, linear, 1–1.5 cm long, 1–4 mm wide, obtuse at apex, acutely tridentate above, laterally entire, 3-nerved, generally shorter than internodes, the uppermost much reduced; cyathium campanulate, ca. 1 mm in diameter, glabrous, with oblong fimbriate lobes; nectaries crescent-shaped, truncate at margin, sometimes short-bicornute; styles 0.2–0.3 mm long, nearly free, deeply bifid; schizocarp ovoid, truncate, 3–4 mm long, trisulcate, with suborbicular cocci; seeds ash-gray, oblong, 1.8–2 mm long (without appendage), hexahedral, longitudinally and narrowly 1-furrowed along the transversely wrinkled-folded faces, obliquely truncate, with horizontal scalelike appendage on 0.6–0.7 mm long stalk. May–June.
- 470 Gypsiferous and saline slopes with solid sandy soil. — Centr. Asia: Pam.-Al. (environs of Shirabad in the southwest). Endemic? Described from Angor st. near Shirabad. Type in Leningrad.

139. *E. sororia* Schrenk in Bull. Phys.-Math. Acad. Petersb. III (1845) 308; Ldb. Fl. Ross. III, 559; Boiss. in DC. Prodr. XV, 2, 100.—*Tithymalus sororius* (Schrenk) Kl. et Gke, ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 65, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 126.—Ic.: Prokh. l. c. tabl. 38.

Annual plants, 7–20 cm high, glabrous, glaucous; root thin; stem erect, usually half the length of the plant or slightly longer; lower cauline leaves (and cotyledons) opposite, the upper usually alternate, all deciduous. Inflorescence loose, corymbiform; terminal peduncles 2–3, bifurcate for many times; leaves of the numerous involucels 2 of each, sessile, linear-lanceolate or sometimes ovate-lanceolate, 1–2 cm long, 2–5 mm wide, obtuse or acute, more or less unequal-sided, entire, mostly 3-nerved; cyathium narrowly campanulate, 1–1.5 mm in diameter, with ovate obtuse lobes; nectaries crescent-shaped, emarginate, short-bicornute; styles 0.4–0.6 mm long, free, bifid; schizocarp ovoid, truncate, 3–3.5 mm long, 2.5–3 mm wide, trisulcate, with smooth orbicular cocci; seeds ash-gray, ca. 2.5 mm long without appendage, hexahedral, longitudinally and narrowly 1-furrowed at faces, transversely folded-wrinkled, obliquely truncate, with horizontal flat appendage on 0.3–0.5 mm long stalk. April–May. (Plate XXIII, Figure 8.)

Sands and solonchak meadows.—Centr. Asia: Balkh. Endemic. Described from Bizhe River. Type in Leningrad.

140. *E. aserbajdzhanica* Bordz. in Byull. Kievsk. Bot. Sada, VII–VIII (1928) 19.—*Tithymalus pseudosororius* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 556; Prokh., Obz. moloch. Sr. Azii, 128.—*Euphorbia sororia* auct.; Boiss. Fl. or. IV (1879) 1091, p. p. non typ.; Lipskii in Tr. B. S. XIII, 334, non Schrenk (1845).—*Tithymalus aserbajdzhanicus* (Bordz.) Prokh., comb. nova, nomen altern.—Ic.: Bordz. l. c. f. 5 (seeds); Prokh., Obz. moloch. Sr. Azii, tabl. 39.

Annual plants, 5–10 cm high, glabrous, very glaucous; stems less than $\frac{1}{2}$ the length of the plant (in all only 4–5 internodes), usually simple; cauline leaves alternate (the linear cotyledons and the lowermost opposite), linear-oblong, acute, entire, 3-nerved, becoming dry. Inflorescence loose, corymbiform; terminal peduncles 2–3, bifurcate for many times; leaves of the numerous involucels 2, sessile, 471 entire, 3-nerved, the lower longer than internodes, slightly unequal-sided, linear-lanceolate or oblong-linear, 1–2 cm long, 3–4 mm wide, acute, cartilaginous at margin, the uppermost more or less oblique at base, oblong-lanceolate or oblong or oblong-ovate, 5–15 mm long, 3–5 mm wide, short-cuspidate; cyathium campanulate, 1–1.5 mm in diameter, glabrous, with ovate emarginate ciliate lobes; nectaries crescent-shaped, usually bicornute, with small filiform horns; cyathia with 5 staminate flowers; styles 0.6–0.7 mm long, nearly free, deeply bifid; schizocarp drooping on distinct pedicel, truncate-ovoid, 2.5–3.5 mm long, glabrous, deeply trisulcate, with smooth obtusely keeled cocci; seeds ash-gray, oblong, 2–3 mm long, hexahedral (i. e., tetrahedral, with inflated outer faces due to 2 on each longitudinal furrow appearing double), all faces longitudinally and narrowly 1-furrowed and transversely wrinkled-folded, obliquely truncate, with white obtuse conical subsessile appendage. (Plate XXIII, Figure 4.)

Dry stony slopes.—Caucasus: S. Transc. (vicinity of Nakhichevan); Centr. Asia: Mtn. Turkm. (Greater Balkhan). Gen. distr.: Iran. (Soh, between Isfahan and Teheran). Described from the vicinity of Nakhichevan in Transcaucasia. Type in Kiev.

141. *E. consanguinea* Schrenk in Fisch. et Mey. Enum pl. nov. Schrenk lect. I (1841) 88; Ldb. Fl. Ross. III, 559; Boiss. in DC. Prodr. XV, 2, 100. — *Tithymalus consanguineus* (Schrenk) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 64, nomen altern.; Prokh., obz. moloch. Sr. Azii, 129. — Ic.: Boiss. Ic. Euph. tab. 52; Prokh. l. c. tabl. 40.

Annual plants, 5–22 cm high, glabrous, glaucous; root thin; stem reduced, 2–5 cm high; cauline leaves opposite (below) or alternate, linear-spatulate, deciduous. Inflorescence corymbiform; terminal peduncles 2, bifurcate for many times; the lower elongate; leaves of the numerous involuclers 2, sessile, rounded or slightly attenuate at base, nearly equal-sided, linear, 2–3.5 cm long, 2–5 mm wide (the uppermost reduced, linear-lanceolate), obtuse or abruptly subcuspidate, cartilaginous at margin, subentire, 1-nerved; cyathium campanulate, 1–1.5 mm in diameter, with triangular-lanceolate dentate lobes; nectaries crescent-shaped, usually bicornute, with short subulate horns; styles filiform, 0.5–0.7 mm long, free, deeply bifid; schizocarp ovoid, truncate, 3–4 mm long, trisulcate, with orbicular hardly netted-rugose cocci; seeds ash-gray, oblong, 2–2.5 mm long, hexahedral, longitudinally and narrowly 1-furrowed and transversely wrinkled-472 folded at faces, truncate below, pyramidally acuminate at apex, without appendage. April, Fr. May. (Plate XXIII, Figure 7.)

Sands.—Centr. Asia: Balkh. (Arganat Mountain in the east), Kara K. (Tedzhen and Murgab river systems in the south). Endemic? Described from Arganat Mountain in Dzungaria. Type in Leningrad.

142. *E. turczaninowii* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV (1842) 447; Ldb. Fl. Ross. III, 559; Boiss. in DC. Prodr. XV, 2, 100; Fl. or. IV, 1092; Prokh. in Izv. Akad. Nauk SSSR (1927) 197; Kryl., Fl. Zap. Sib. VIII, 1864. — *E. carnosa* Paulsen in Bot. Tidsscr. XXVII (1906) 131. — *Tithymalus turczaninowii* (Kar. et Kir.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 64, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 131. — Ic.: Prokh., obz. moloch. tabl. 41.

Annual plants, 4–13 cm high, glabrous, glaucous; root thin; stems reduced, 1–3 cm high; cauline leaves (except cotyledons) mostly alternate, cuneate at base, obovate, 1–1.5 cm long, 2–6 mm wide, obtuse, deciduous. Inflorescence corymbiform; terminal peduncles 2, bifurcate for many times, the upper strongly reduced; leaves of the numerous involuclers 2 of each, sessile, obliquely cuneate at base, oblong-lanceolate, 1–3 cm long, 5–15 mm wide (the uppermost small and approximate), usually abruptly short-acuminate, cartilaginous at margin, often denticulate, palmately veined; cyathium narrowly campanulate, 1–1.5 mm in diameter, with ovate fimbriate lobes; nectaries crescent-shaped or transversely oblong, bicornute, with short subulate whitish horns; styles 0.4–0.5 mm long, free, bifid; schizocarp ovoid, truncate, 2.5–3 mm long, trisulcate, with smooth orbicular cocci; seeds ash-gray, oblong, 2–2.5 mm long, appearing hexahedral due to 2 longitudinal branched folds and furrows on each of the 2 outer faces and only 1 on the inner, truncate at base, pyramidally acuminate at apex, without appendage. May.

Sands, especially sand dunes.—Centr. Asia: Ar.-Casp. (S.), Balkh., Syr D. (Chirchik River valley in the north), Kyz. K., Amu D., Kara K.

Gen. distr.: Dzu.-Kash. (Kuldja District and Chinese Dzungaria). Described from sand dunes between Sassyk-Pastau and Arganaty Mountain in Dzungaria. Type in Leningrad.

143. *E. arvalis* Boiss. et Heldr. Diagn. ser. 1, XII (1853) 116; Boiss. Fl. or. IV, 1114. — *E. punctata*; auct. Ldb. Fl. Ross. III, 571, non Delile; Boiss. in DC. Prodr. XV, 2, 143, p. p. — ? *E. ruderalis* Scheele in Linnaea, XVII (1843) 343. — ? *E. parvula* C. Koch in Linnaea, XXI (1847) 731. — *Tithymalus arvalis* (Boiss. et Heldr.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 82, nomen altern.
- 473 Annual plants, (5)8–15 cm high, glabrous, glaucous; stem solitary, low, 2–5 cm high, only $\frac{1}{3}$ to $\frac{1}{2}$ ($\frac{2}{3}$) the length of the plant, with 1–6 axillary peduncles nearly basal (1–3.5 cm long up to first branching) or sometimes without, always without sterile branches; cauline leaves alternate, sessile, tapering at base, obovate-oblong, 9–21 mm long, 3–7 mm wide, obtuse, thick, entire. Inflorescence pseudo-dichasial; terminal peduncles 3, 1.2–3.5 cm long, like axillary peduncles many times (up to 7 and more) bifurcate, the axillary sometimes monochasial; leaves of involucre spatulate-elliptic, 14–21 mm long, 4–7 mm wide; leaves of involucels 2, slightly cordate or short-cuneate at base, obliquely ovate-elliptic or obliquely oblong-ovate, 7–16 mm long, 5–11 mm wide (the terminal smaller), obtuse, sometimes short-cuspidate, entire; cyathium turbinate, only 1 mm in diameter, scarious, with oblong fimbriate lobes; nectaries pink, transversely oblong, bicornute, with horns as long as width of nectary, sometimes abortive; styles 0.4–0.5 mm long, bifid; schizocarp flattened-ovoid, 2.2–2.5 mm long, 2.5–3 mm wide, deeply trisulcate, glabrous, with dorsally orbicular cocci; seeds whitish, ovate, orbicular-tetrahedral, 1.5–1.7 mm long, 1–1.3 mm wide, densely tuberculate-rugose or if tubercles confluent then folded-wrinkled, with conical, later furrowed, scarious, subsessile (deciduous) appendage. May–June. (Plate XXIII, Figure 2.)

Mountain slopes and cliffs, fallow lands. — Caucasus: S. Transc., Tal. **Gen. distr.:** As. Min., Arm.-Kurd., Iran. Described from pastureland between Isparta and Egridir in Pisidia, Asia Minor. Type in Geneva.

Note. In case *E. ruderalis* Scheele (1843) or *E. parvula* C. Koch (1847) are proved to be identified with *E. arvalis* Boiss. et Heldr. (1853), then *E. arvalis* should become a synonym of one of the other two species since it is the later name.

144. *E. densa* Schrenk in Bull. Phys.-Math. Acad. Petersb. III (1845) 308; Ldb. Fl. Ross. III, 560; Boiss. in DC. Prodr. XV, 2, 100; Fl. or. IV, 1091. — *Tithymalus densus* (Schrenk.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 65, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 135. — Ic.: Proks. 1. c. tabl. 42.

Annual plants, 3–10 cm high, glabrous, glaucous; root thin; stem erect, reduced (1–3.5 cm high), sometimes with axillary peduncles above; lower cauline leaves opposite, the upper usually alternate, all with long petioles (up to 1 cm long and twice as long as blades), cuneate at base, obovate or spatulate, 7–13 mm long, 5–8 mm wide, obtuse or emarginate, subentire, deciduous. Inflorescence spreading; terminal peduncles 2–3, like axillary

474 peduncles bifurcate for many times, the upper very short; leaves of the numerous involucels 2, the lower sparse, short-petiolate, orbicular-obovate, denticulate, the upper very dense (fall specimens), sessile, suborbicular, 4–12 mm long and wide, abruptly short-cuspidate, acutely denticulate at

apex; cyathium broadly campanulate, 1–1.5 mm in diameter, glabrous, with oblong dentate lobes; nectaries reddish, crescent-shaped (or transversely oblong), bicornute, with short subulate diverging horns; styles thick, 0.4–0.5 mm long, free, bifid; schizocarp ovoid, truncate, ca. 3 mm long, 2.5–3 mm wide, faintly trisulcate, with smooth slightly keeled cocci; seeds greenish-gray or ash-gray, oblong, 2–2.2 mm long, tetrahedral, faces with shallow longitudinal furrow and transversely folded-rugose or sparingly pitted, with erect subglobular subsessile appendage at the obliquely truncate apex. April–May. (Plate XXIII, Figure 5.)

Sands and saline slopes. — Centr. Asia: Ar.-Casp. (left bank of Sary-Su River in the southeast), Balkh. (along Chu and Dzhambul rivers in the southwest), Syr D., Kyz. K., Amu D., Kara K., Mtn. Turkm. **Gen. distr.:** Iran. Described from solonchaks in Semirech'e near Dzhambul. Type in Leningrad.

145. *E. szovitsii* Fisch. et Mey. Ind. sem. hort. Petrop. I (1835) 27; Ldb. Fl. Ross. III, 560; Boiss. in DC. Prodr. XV, 2, 143; Fl. or. IV, 1113. — *Tithymalus szovitsii* (Fisch. et Mey.) Kl. et Gke. ex Klotzsch in Abh. Akad. Berl. 1859 (1860) 65, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 138. — Ic.: Boiss. Ic. Euph. tab. 96; Prokh. l. c. tabl. 44. — Exs.: G. R. F. No. 2576.

Annual plants, 3–12 cm high, glabrous, glaucous; root thin, vertical; stem erect, half the length of the plant or slightly more, 2–7 cm high, simple, sometimes with axillary peduncles above; cauline leaves cuneate, at base, linear-spatulate, 2–15 mm long, 1.5–3 mm wide, obtuse or sometimes even emarginate, subentire, fleshy, with 3 obscure nerves below, usually deciduous. Terminal peduncles 3–5, generally spreading, like axillary peduncles bifurcate for many times; leaves of involucre similar to the cauline; leaves of the numerous involucre 2, the lower oblong- or linear-lanceolate, 8–20 mm long, 2–4 mm wide, falcately curved, obtuse, the upper shorter and approximate; cyathium campanulate, 1–1.5 mm in diameter, with oblong ciliate lobes; nectaries reddish, crescent-shaped, nearly hornless; styles 0.3–0.4 mm long, shortly 2-lobed; schizocarp ovoid, truncate, 2.5–3 mm long, trihedral, acutely keeled, hardly furrowed between cocci, smooth, shiny except for ribs; seeds ash-gray, oblong, 1.5–2 mm long, tetrahedral, with few irregular transverse wrinkles and tubercles at faces, straight at base and obliquely truncate at apex, with obtuse conical subsessile appendage. Fl. May, Fr. June. (Plate XXIII, Figure 6.)

Pebbly slopes, taluses and coastal gravels. — Caucasus: Dag., E. Transc. (only Khanlar), S. Transc., Tal. Centr. Asia: Pam.-Al. (north and west), Mtn. Turkm. **Gen. distr.:** Iran. Described from N. Iran. Type in Leningrad.

Subsection 3. *DENSIUSCULAE* Prokh. subsect. nova in Addenda XIII, 743. — See page 255 of the Key for characteristics of the subsection.

E. densiuscula M. Pop. is sufficiently distinguished from the species of the preceding subsection to be separated into a special subsection.

146. *E. densiuscula* M. Pop. in Tr. Turkest. nauchn. obschch. I (1923) 38. — *Tithymalus densiusculus* (M. Pop.) Prokh., Obz. moloch. Sr. Azii (1933) 137, nomen altern. —? *Galarhoeus densiusculi* —

formis Pazij in Bot. Mat. Gerb. Inst. Bot. i Zool. Akad Nauk UzbSSR, XI (1948) 26. — Ic.: Prokh., l. c. tabl. 43.

Annual plants, 5–10 cm high, green, sparsely spreading-hairy; root thin, vertical; stems ca. $\frac{1}{2}$ the length of the plant; cauline leaves alternate, cuneate at base, obovate, obtuse, entire, rather thick, deciduous and leaving scars. Inflorescence corymbiform; terminal peduncles 2–3, bifurcate for 2 to many times, the lower elongate and erect; leaves of involucre similar to the cauline but slightly shorter and wider, acute or obtuse, deciduous; leaves of involucels 2, orbicular or rhombic, transversely oblong or broadly ovate, 3–7 mm long, 3–8 mm wide, obtuse, sometimes abruptly short-cuspidate, sometimes more or less connate in pairs, entire; cyathium 1–1.5 mm in diameter, sparsely hairy outside, with ovate brown lobes undulate at margin; nectaries yellowish, transversely elliptic, bicornute, with subulate horns, as long as width of nectary; staminate flowers with pinnate bracts and hairy pedicels; styles thick-cylindrical, 0.8–1 mm long, free, bifid; schizocarp large, truncate-ovoid, triquetrous, ca. 4 mm long, slightly trisulcate, with nearly smooth (hardly netted-rugose) keeled cocci; seeds ash-gray, ovate, ca. 2.5 mm long, 1.2–1.4 mm wide, tetrahedral, slightly transversely furrowed-pitted, without appendage. April–May.

Salt-bearing sandstone mountains. — Centr. Asia: Pam.-Al. (vicinity of Baisun). Endemic. Described from the vicinity of Baisun near Katta-Kamysh. Type in Tashkent.

- 476 Note. *Galarhoeus densiusculiformis* Pazij, which was recently described from the same places as *Euphorbia densiuscula* M. Pop., is referred here to the latter. The distinguishing characters reported in the diagnosis (glabrescence of the plant and the transversely rugose seeds) are obviously not sufficient to differentiate species with corresponding distribution areas. Moreover, the transversely rugose seeds are also common to *E. densiuscula* M. Pop. and for this reason should be ignored. The leaves of the involucels of *G. densiusculiformis* are, according to the description, slightly longer ($1\frac{1}{2}$ times longer than wide) when compared with the measurements of those of *E. densiuscula*; nevertheless, although the leaves of the involucels are not equal, their measurements still partially overlap. Hence it remains only to accept *G. densiusculiformis* as the glabrous form from the earlier places of *E. densiuscula*.

Section 9. DEMATRA (Rafin.) Prokh. sect. comb. nova. — *Dematra* Rafin. *Autikon botanikon* (1840) 96. — *Ctenadena* Prokh., *Obz. moloch. Sr. Azii* (1933) 28. — Subsection *Crotonopsidae* Boiss. in *DC. Prodr.* XV, 2 (1862) 101; Fl. or. IV, 1083, 1092. — See page 237 of the Key for characteristics of the section.

Note. This monotypic section is so unique that twice it has been separated into an independent genus — once by myself in 1933 when I was unaware of Rafinesque's earlier name.

Morphologically, the section *Dematra* is the transitional link to the sympatric subgenus *Cystidospermum* with which it shares palmately parted nectaries, entire styles, long-petioled leaves with characteristic shape, craspedodromous venation, and awned teeth. Nevertheless, owing to the development, even at the beginning, of a short monopodial stem with alternate leaves, distinct from the above cymose inflorescence, and the absence of stipules, we prefer to include the section *Dematra* in the sub-



PLATE XXIV. 1—*Euphorbia nutans* Lagasca.; 2—*E. humifusa* Willd.; 3—*E. cheirolepis* Fisch.et Mey.; 4—*E. maculata* L.; 5—*E. forskalii* J.Gay.

genus *Paralias* in spite of its being not a typical but a deviated group.
E. lanata Spreng., the only species of the section.

147. *E. lanata* Sieber ex Spreng. Syst. III (1828) 792; Boiss. in DC. Prodr. XV, 2, 101; Fl. or. IV, 1092. — *Dematira sericea* Raf. Autikon botanikon (1840) 96. — *Ctenadena lanata* Prokh., Obz. moloch. Sr. Azii (1933) 28, olim. — *Tithymalus lanatus* (Sieb. ex Spreng.) 479 Prokh. comb. nova, nomen altern. — Ic.: Boiss. Ic. Euph. tab. 53; Prokh. l. c. tabl. 6.

Annual plants, 15–30 cm high, appressed-tomentose; root thin, vertical; stem erect, 5–10 cm long, branching, usually with few axillary peduncles; cauline leaves alternate, elliptic or ovate, 3.4–3.6 cm long, 1.8–2.2 cm wide, obtuse, deciduous. Inflorescence broadly spreading; terminal peduncles 2, rarely 3, many times bifurcate; leaves of involucre like upper cauline leaves; leaves of the numerous involucels 2, with 0.5–1 cm long petioles, ovate, 1.5–2.3 cm long, 0.9–1.6 cm wide, awned-dentate, gray-hairy beneath; cyathium broadly campanulate, 3–4 mm in diameter, villous inside and out, with triangular-ovate fimbriate lobes; nectaries transversely oblong, concave, hairy below, pectinately incised into 2–8 subulate lobes, the marginal longer; styles $\frac{3}{4}$ to 1 mm long, thickened, twisted, entire; schizocarp ovoid, 5–6 mm long, 5.5–6.5 mm in diameter, trisulcate, with keeled cocci, lanate; seeds whitish, oblong, tetrahedral, 3.5–4.5 mm long, flattened below, obtusely tuberculate, obliquely truncate, with obtuse conical stalked appendage. Fl. June, Fr. August–September.

Weed. — Centr. Asia: Mtn. Turkm. (near Ashkhabad). Gen. distr.: E. Med., Iran. Described from the vicinity of Jerusalem. Type was in Berlin.

Section 10. *EPURGA* Prokh. sect. comb. nova. — Gen. *Tithymali* subgen. *Epurga* Prokh., Obz. moloch. Sr. Azii (1933) 56. — *Epurga* Fourr. (nomen) in Ann. Soc. Linn. Lyon N. S. XVII (1869) 150. — Subsection *Decussatae* Boiss. in DC. Prodr. XV, 2 (1862) 99. — See page 237 in Key for characteristics of the section.

Note. A monotypic section with a single polymorphic species — *E. lathyris* L. The globose, berry-shaped, indehiscent fruit with spongy mesocarp and the opposite arrangement of leaves along the main stem place the section in a rather separate position within the subgenus *Paralias*. This is evidently a progressive group that has recently developed.

148. *E. lathyris* L. Sp. pl. (1753) 457; Ldb. Fl. Ross. III, 572; Boiss. in DC. Prodr. XV, 2, 99; Hegi, Ill. Fl. V, 1, 146. — *E. spongiosa* Ldb. ex Schrank in Syll. Ratisb. L. (1824) 214. — *Tithymalus Lathyris* (L.) Scop. Fl. carn. ed. 2, I (1772) 332, nomen altern.; Prokh., Obz. moloch. Sr. Azii, 56. — *Galarhoeus Lathyris* Haw. Syn. pl. succ. (1812) 143. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 143, f. 4783; Hegi, Ill. Fl. V, 1, f. 1758.

Annual plants, 60–100 cm high, glabrous, glaucous; root vertical; stem solitary, erect, rather thick (7–10 mm), with axillary peduncles above and sterile branches below; cauline leaves all opposite, with petioles up to 4 mm 480 long and 5 mm wide, slightly cordate at base, linear-lanceolate, 10–16 cm long, 1–2.2 cm wide (the lower approximate and narrower), acuminate,

cuspidate or obtuse, incurved at margin, entire, more or less thick, dark green and shiny above, paler beneath, glaucescent-gray, with 1 prominent nerve; leaves on sterile branches smaller. Terminal peduncles 4, 4–5 cm long, like axillary peduncles bifurcate for 1–3 times, rarely only with 1 secondary peduncle at each node; leaves of involucre hardly petiolate or subsessile, oblique-cordate at base, triangular-lanceolate, 3–10 cm long, ca. 2.5 cm wide; leaves of involucels 2, oblique and slightly cordate at base, triangular-ovate, acute or acuminate, palmately 5–7-nerved, the lower up to 6 cm long and up to 3 cm wide, the terminal smaller; cyathium turbinate, ca. 2.5 mm long, 3 mm wide, glabrous, pale green, lobes oblong-ovate (ca. 1 mm long), obtuse, glabrous, crenate at apex; nectaries crescent-shaped, emarginate at margin, bicornute, with diverging spatulate obtuse horns; staminate flowers ebracteate at base; styles ca. 3 mm long, bifid for $\frac{1}{4}$ the length; schizocarp globose, truncate, 1–1.2 cm long, 1.4–1.6 cm wide, not parted, with thick (up to 4 mm) soft spongy pericarp, smooth (wrinkled when dry), longitudinally weakly 6-furrowed (3 of which similar to 3 basic furrows and additional 3 at the middle of carpels); seeds dark brown, ovate, 7–8 mm long, 4–5 mm wide, smooth at first, later netted-rugose, with a segment (ca. 1.5 mm in diameter) of white smooth sessile appendage lobed at margin. July–August.

Weed and cultivated. — Caucasus: introduced into W. Transc. (near Kutaisi), under cultivation in Cisc. (near Krasnodar). **Gen. distr.:** Jap.-Ch. (cultivated and definitely wild), introduced into Atl. Eur., W. Med., N. Am. (Mexico) and S. Am. (Peru), cultivated in Dzu.-Kash. (Kuldja District). Described from W. Europe (France, Italy), from edges of pastures. Type in London.

Note. Characterized to a certain degree by an enigmatic, disjunct distribution area; it occurs on the one hand as a weed in the western part of Europe and on the other in the Far East in mass cultivation as well as in the wild (western part of mountainous China). It is apparent that this spurge was introduced into Europe from the East during the Middle Ages.

Economic importance. The plant is cultivated in China and Japan, especially for its oil-producing seeds. Recently, it has started to attract interest in the USSR.

Subgenus 2. *Cystidospermum* Prokh. subgen. comb. nova. — *Cystidospermum* Prokh., *Obz. moloch. Sr. Azii* (1933) 25. — Section *Cheirolepidium* Boiss. in DC. *Prodr.* XV, 2 (1862) 70; Fl. or. IV, 1083, 1089. — See page 236 of the Key for characteristics of the subgenus.

481 The subgenus *Cystidospermum* was first described by me as a separate genus for which there was at the time a reasonable basis; it is hardly suitable now to establish small separate genera until the whole genus *Euphorbia* L. is treated monographically.

Furthermore, *Cystidospermum* is to a certain extent a morphological link between the preceding subgenus *Paralias*, to which it is similar by the absence of petaloid appendages in the nectaries, and the following *Chamaesyce*, with which it shares the opposite leaves and interpetiolar stipules.

Two species, in addition to *E. postii* Boiss., originating from the sandy deserts of Iran and Turan lowland, are included in *Cystidospermum*. Type of subgenus: *E. cheirolepis* Fisch. et Mey.

149. *E. cheirolepis* Fisch. et Mey. ex Ldb. Fl. Ross. III (1849–1851) 558; Boiss. in DC. Prodr. XV, 2, 70; Fl. or. IV, 1089. — *Cystidospermum cheirolepis* (Fisch. et Mey. ex Ldb.) Prokh., Obz. moloch. Sr. Azii (1933) 26, nomen altern. — Ic.: Prokh. l. c. tabl. 5. — Exs.: G. R. F. No. 2571.

Annual plants, 20–45 cm high; root thin, vertical; stems more or less erect, many times furcately branching; leaves usually varying in shape, the lower (except cotyledons) alternate, petiolate, linear or narrowly lanceolate, 5–8 cm long, 2–6 mm wide, acute, sparsely toothed or sometimes entire, the upper opposite, distinctly petioled, usually elliptic or obovate, 0.5–2.5 cm long, 0.5–1.2 cm wide, obtuse, sparsely acutely toothed, all more or less pubescent or sometimes glabrous, 1-nerved; stipules small, subulate, often acutely toothed. Cyathia solitary in bifurcations, campanulate, 2.5–4 mm wide, densely pubescent, with ovate ciliate lobes; nectaries 4–5, subequal, transversely oblong, pectinately incised into 3–5 subulate lobes, at first short, later elongating; styles 3–4 mm long, half-connate, entire, more or less twisted; schizocarp truncate-ovoid, 4–5 mm long, trisulcate, with orbicular cocci, villous, pericarp scarious; seeds oblong, 3–4 mm long, rugulose, obliquely truncate, with vesicle-like bicornute appendage, horns appressed to and more than half as long as seeds. May–September (Plate XXIV, Figure 3.)

Sands, usually sand-dunes. — Centr. Asia: Ar.-Casp. (Aral Sea in the south), Syr D., Pam.-Al. (Shirabad valley in the southwest), Amu D. (sands of Sandukli), Kyz. K., Kara K., Mtn. Turkm. Gen. distr.: Iran. Described from Turkmenia. Type in Leningrad.

Note. This species is characterized by the extreme variability in the shape of the leaves (like *E. bungei* Boiss. and *E. ispahantica* Boiss. from the same localities). An especially narrow-leaved variety of *E. cheirolepis* F. et M. is var. *longifolia*, in which the elongated shape of the first leaves is kept along the entire length of the stem. Is this not merely a modification?

Subgenus 3. *Chamaesyce* (S. F. Gray)? L. C., Wheeler in Contrib. Gray Herb. CXXXV (1941). — *Chamaesyce* S. F. Gray, Nat. Arr. Brit. Pl. II (1821) 260; Small, Fl. southeast. U. S. 707; Millsp. in Field Columb. Mus. Publ. 136, Bot. ser. II, No. 7, 300, et Publ. 179, Bot. ser. II, No. 10, 395; Prokh., Obz. moloch. Sr. Azii, 14; Tr. Kuibyskh. Bot. Sada, I, 7; Croizat et Degener in Degener, Fl. Hawaiiensis, Fam. 190. — *Anisophyllum* Haw. Syn. pl. succ. (1812) 159, non Jacq. (1763); Klotzsch in Monatsb. Akad. Berl. (1859) 247. — *Ditrita* Rafin. Sylva tellur. (1838) 115. — Section *Anisophyllum* Boiss. in DC. Prodr. XV, 2, 11–52; Fl. or. IV, 1086–1089; Prokh. in Izv. Akad. Nauk SSSR (1927) 195; Kryl., Fl. Zap. Sib. VIII, 1863. — See page 236 of the Key for characteristics of the subgenus.

This subgenus is sufficiently distinguished to be separated into a genus, which is what we did earlier, as did many other authors; yet, viewing the whole diversity of the genus *Euphorbia* L. in the broad sense, some morphologically intermediate forms, like the preceding subgenus *Cystidospermum*, make it difficult to raise the subgenera as independent definite genera. Moreover, the characteristic habit (branching and stipules) of the species of *Chamaesyce* is unknown in the Russian spurges, and it generally concerns the vegetative parts; the generative parts differ only by the presence of petaloid appendages of the nectaries.

The subgenus *Chamaesyce* is accepted here in the sense of the genus *Chamaesyce* in Croizat. We both include in *Chamaesyce* not only the species with furcately dichasial branching, like the Russian ones, but also the exotic forms with narrower monochasia yet also with opposite leaves.

The loss of monopodial branching is evidence of the adaptability of the subgenus to extreme arid habitats with low precipitation.

There are about 250 species in the subgenus, most of which are confined to the deserts and littoral parts of tropical America and the islands of Polynesia where the woody forms are quite common.

Some of the Russian species are dichasial annuals of dry steppes and in other cases of coastal areas. Some *Chamaesyce* easily become weeds following cultivation. Such species often penetrate countries far from their native habitat and thus it is not surprising to find that of the 10 Russian species of *Chamaesyce*, only 6 are indigenous, the other 4 having been introduced into the USSR.

We are refraining from subdividing *Chamaesyce* into sections and subsections; such a step would be possible only after its universal diversity, notably in America, is defined.

Type of subgenus: *Euphorbia peplis* L.

- 483 1. Cyathia at ends of branches of terminal cymose umbels, the lower remote, sometimes appearing solitary in bifurcations; stems usually erect or ascending; developed leaves (1.5)2–3.5 cm long, rounded or obliquely cordate at base, with 3–5 nerves, ovate-oblong, sometimes linear; plants more or less pubescent 2.
- + Cyathia solitary in bifurcations, but with reduction of peduncles often approximate, forming spurious leafy pseudoracemose (not cymose umbel) inflorescence; stems usually procumbent; leaves relatively small, shorter than 1.5 cm; seeds reddish or gray, not blackish 3.
2. Furcate branching of stem rather equal; cyathia in polychasial terminal inflorescences but solitary ones also occurring in bifurcations; schizocarp 2–2.5 mm wide, glabrous; seeds blackish, with numerous irregular transverse wrinkles; appressed-pubescent and sparsely long-hairy plants 150. *E. nutans* Lag.
- + Furcate branching of stem unequal, nearly sympodial [?], i. e., one branch more strongly developed appearing like the continuation of the supporting internode, the second branch weaker, like a short axillary sided branch; polychasial inflorescence usually appearing lateral; schizocarp ca. 2 mm wide, coarsely appressed-hairy; seeds

- 1–1.2 mm long, blue-reddish with grayish rim or wholly whitish-gray, with 5–6 interrupted and interwoven transverse wrinkles; plant finely short-hairy 151. *E. indica* Lam.
3. Seeds smooth, finely papillate when ripe; schizocarp glabrous; cyathia solitary in bifurcations in upper part of plant; appendages of nectaries subequal, narrow, not wider than nectaries; Russian plants mostly glabrous 4.
- + Seeds, at least on the 2 outer faces, with straight transverse furrows or numerous transverse wrinkles; schizocarp glabrous or more or less pubescent; appendages of nectaries often distinctly wider than nectaries, or nearly absent 5.
4. Robust plant, stems and branches more or less thick; leaves 8–12 mm long, fleshy, very asymmetrical at base (at one side deeply cordate-auriculate and slightly denticulate, at the other obliquely truncate), entire for the most part; styles very short, with spatulate lobes at summit; schizocarp 3.5–5 mm wide, with rounded cocci, below with small 3–6-parted squamiform perianth; seeds conical-ovate, 2.5–3 mm long 152. *E. peplis* L.
- 484 + Delicate plants, stems and branches thin; leaves 5–10 mm long, not fleshy, slightly asymmetrical at base, more or less serrate above; styles long, deeply bifid; schizocarp 1.5–2 mm wide, with obtusely keeled cocci, perianth obsolete; seeds somewhat tetrahedral, oblong, ca. 1 mm long 153. *E. humifusa* Willd.
5. Internodes not short, not even of fertile branches (at least as long as leaves); cyathia not crowded in inflorescence; schizocarp glabrous or more or less spreading-hairy; styles short or sometimes long . . 6.
- + Internodes of fertile branches short (at least slightly shorter than leaves); cyathia in short dense leafy pseudoracemes appearing axillary; leaves 2–3 times longer than wide; schizocarp coarsely appressed-hairy; styles short 9.
6. Appendages of nectaries subequal; styles short; leaves not more than twice as long as wide 7.
- + Appendages of the outer pair of nectaries distinctly larger than those of the inner pair; leaves more than twice as long as wide 8.
7. Leaves ovate-elliptic, more than $1\frac{1}{2}$ times longer than wide; stems elongate, thin even at base; plants glabrous or often sparsely long-hairy with spreading hairs 154. *E. chamaesyce* L.
- + Leaves suborbicular, hardly longer than wide; stems more or less thickened at base; plants often more or less densely and softly tomentose-canescens 155. *E. canescens* L.
8. Seeds oblong, 2–2 $\frac{1}{2}$ times longer than wide, tetrahedral, with acute ribs and concave, distinctly transversely rugose-furrowed faces, truncate at base, acute; styles inconspicuous; stems short, hardening; appendages of inner pair of nectaries often absent, of outer twice as wide as nectaries 156. *E. turcomanica* Boiss.
- + Seeds ovate, $1\frac{1}{2}$ –2 times longer than wide, orbicular-tetrahedral, very faintly transversely pitted-rugose at faces, obtuse; styles ca. 1 mm long; stems elongate, filiform; appendages of inner pair of nectaries not narrower than nectaries, of outer 4 times wider 157. *E. anisopetala* Prokh.

9. Seeds 1.2–1.5 mm long, irregularly transversely rugose; schizocarp 1.5–2 mm long and wide, with acutely keeled cocci; leaves up to 15 mm long; rather robust plants, with stems firm but easily breaking in nodes (up to 30 cm long) 158. *E. forskalii* J. Gay.
- + Seeds ca. 0.8 mm long, the 2 outer faces 0.5 mm wide, with 3–4 transverse straight disconnected furrows; schizocarp ca. 1.5 mm wide, drooping already at beginning, with obtusely keeled cocci; styles short; cyathium stalked, 0.75 mm long, coarse-hairy inside, entire or incised/parted for not more than half; leaves more or less oblong, 5–9 mm long; weak plants, villous, with thin stems (up to 15 cm long) 159. *E. maculata* L.

150. *E. nutans* Lagasca, Gen. et sp. nov. (1816) 17; Hegi, Ill. Fl. V, 1, 143. — *E. maculata* L. Mant. alt. (1771) 392, non L. (1753). — *E. Preslii* Guss. Fl. Sic. Prodr. I (1827) 539; Boiss. in DC. Prodr. XV, 2, 23. — *E. hypericifolia* auct.; Engelm. in Chapm. Fl. south. U. S. (1860) 403, non L. — *Chamaesyce nutans* (Lagasca) Small, Fl. southeast U. S. (1903) 712, nomen altern. — Ic.: Moggridge, Fl. Mentone (1871) tab. 15 ("*E. Preslii*"); Britt. and Brown, Ill. Fl. N. States and Canade, II (1897) 375 et ed. 2, II (1913) 468. — Exs.: Fl. austro-hung. No. 493.

Annual plants, 15–40 cm high, sparingly long- and short-appressed-hairy; stems usually erect or ascending, sparingly long-hairy above, rarely below, sporadically with very short and appressed tomentose hairs, alternately pseudodichotomously branching; leaves subsessile, somewhat asymmetrical, rounded or slightly cordate at base, ovate-oblong or lanceolate or linear, (1.5)2–3.5 cm long, (6)8–15 mm wide, obtuse, serrulate (especially below), above usually with long reddish spot; stipules triangular, reddish, fimbriate-ciliate. Cyathia few in dense terminal subglobular polychasial inflorescences supported by a pair of terminal leaves, sometimes also solitary in upper bifurcations of stem; cyathium narrowly turbinate, 1–1.2 mm long, glabrous outside, coarse-hairy inside, with lanceolate lobes; nectaries 4, with wider, ovate-orbicular, entire or obscurely emarginate appendages, white, slightly reddening at base; styles 0.5–0.75 mm long, bifid; schizocarp 2–2.5 mm long, 1.8–2.5 mm wide, glabrous, with slightly keeled cocci; seeds ovate, tetrahedral, 1–1.2 mm long, nearly black when ripe, with numerous irregular transverse wrinkles. July–September. (Plate XXIV, Figure 1.)

As a weed in cultivated fields and along roadsides, often along seashores. — Caucasus: introduced into W. Transc. (Abhazia; Gagry, Petskirscoe Gorge). **Gen. distr.:** Centr. Am., tropical S. Am., introduced into Centr. Eur. (S.) and Atl. Eur., W. Med. Described from America ("New Spain"). Type in Madrid.

- 486 151. *E. indica* Lam. Dict. Bot. II (1786) 423; Boiss. in DC. Prodr. XV, 2, 22; Fl. or. IV, 1086. — *Chamaesyce indica* (Lam.) Prokh. nomen altern.

Annual plants, 15–30 cm high, glaucescent, finely short-hairy, at least on petioles and peduncles of various cyathia; stems ascending or decumbent, hairy, branching; leaves short-petiolate, rounded at base, obovate, obtuse, remotely and usually inconspicuously serrate, sparingly appressed-short-hairy, paler beneath; stipules dilated at base then setaceous, ciliate.

Polychasial cymose inflorescences capitate, loose axillary, on short peduncles usually with 2 basal leaves as long as inflorescence; cyathium turbinate, glabrous outside and inside, with triangular somewhat fimbriate lobes; nectaries 4, ovate, with ovate-orbicular white appendage as wide as nectary or narrower; styles ca. 0.5 mm long, bifid; schizocarp ca. 1.5 mm long, 2 mm wide, usually appressed-hairy, with slightly keeled cocci; seeds ovate, tetrahedral, 1–1.2 mm long, blue-reddish with grayish rim or completely whitish-gray, at each face with 5–6 transverse interrupted interwoven wrinkles.

Weed. — Caucasus: introduced into W. Transc. Gen. distr.: tropical Africa, Ind.-Him. Described from East Indies. Type in Paris.

Note. There are no specimens of this species in the herbarium of the Botanical Institute (Leningrad). It is included on the basis of A. A. Grossgeim's data.

152. *E. peplis* L. Sp. pl. (1753) 455; M. B. Fl. taur.-cauc. I, 369; Ldb. Fl. Ross. III, 558; Boiss. in DC. Prodr. XV, 2, 27; Fl. or. IV, 1086. — *Chamaesyce peplis* (L.) Prokh., Obz. moloch. Sr. Azii (1933) 15, nomen altern. — Ic.: Engl. Bot. tab. 2002; Rchb. Ic. Fl. Germ. V, tab. 131, f. 1753; Hegi, Ill. Fl. V, 1, f. 1755. — Exs.: Fl. austro-hung. No. 494.

Annual plants, glabrous, slightly fleshy, glaucous, bluish or whitish-green, reddening at end; stems creeping, 5–25 cm long, thick and fleshy, usually with inflated nodes, striate-ribbed, hardening at base, pseudo-dichotomously strongly branching, with internodes 2–5 cm long; leaves with petioles 1–3 mm long, strongly asymmetrical and deeply cordate at the often denticulate base, auricled at one side and cut at the other, ovate-oblong or oblong-rhombic, 7–13 mm long (without auricle), 2.5–8 mm wide, obtuse or slightly emarginate at apex, entire or denticulate; stipules interpetiolar, bi- or trifid, subulate, ca. 1.5 cm [?] long. Cyathia solitary in bifurcations or appearing axillary, stalked, campanulate, 1.2–1.5 mm long, 1.5–2 mm in diameter, short-hairy inside, with small triangular ciliate lobes; nectaries 4, transversely oblong, narrow, 0.5 mm long, concave above, often reddish, with narrow entire or slightly lobed white appendage; styles relatively thick, very short (ca. 2 mm), each with 2 spatulate lobes at summit; calycine perianth around pistillate flower more or less distinct, composed of 3 or 6 oblong-triangular usually bifid lobes; schizocarp globulose-triangular, (2.8)3.5–4.5 mm long, (3.5)4–5 mm wide, shallowly trisulcate, with orbicular cocci; seeds ovate, tetrahedral, ovate-conical, not compressed, 2.7–3.2 mm long, 1.8–2.4 mm wide, acute, nearly smooth at faces, gray, without appendage. June–September.

Seashores of moderately moist sands. — European part: Bes., Bl., Crim.; Caucasus: Cisc. (Taman), W. Transc. Gen. distr.: Atl. Eur., Med., Bal.-As. Min. Described from Narbonne and the shores of Spain. Type in London.

Note. This species is quite distinct from all the Russian *Chamaesyce* because of the calycine, 3 or 6 small-lobed perianth of the pistillate flower, the very short 2-lobed styles attached above to form an almost 6-lobed column, and the especially large involucre, fruit and seeds.

153. *E. humifusa* Willd. Enum. pl. horti berol. Suppl. (1813) 27; Boiss. in DC. Prodr. XV, 2, 30; Fl. or. IV, 1086; Kom., Fl. Man'chzh. II, 685; Hegi, Ill. Fl. V, 1, 144; Prokh. in Izv. Akad. Nauk SSSR (1927), 195. — *E. Chamaesyce* auct.; Pall. Reise, II (1773) 523, 542, non L.; Ldb. Fl. alt. IV, 195. — *E. pseudo-chamaesyce* Fisch. et Mey. in Ind. sem. hort. Petrop. IX (1842) 73; Ldb. Fl. Ross. III, 557; Kryl., Fl. Zap. Sib. VIII, 1863. — *E. polygonisperma* Gren. et Godr. Fl. France, III (1855–1856) 75. — *Chaemaesyce humifusa* (Willd.) Prokh. l. c. nomen altern.; Prokh., Obz. moloch. Sr. Azii, 16. — Ic.: Hegi, Ill. Fl. V, 1, f. 1756; Prokh., Obz. moloch. tabl. 1. — Exs.: Fl. austro-hung. No. 2852; G.R.F. ("*E. humifusa*") No. 2574 ("*E. pseudo-chamaesyce*") No. 2575.

Annual glaucous plants, often reddening when ripe; root thin, vertical; stems few, 5–20(30) cm long, thin, creeping, many times furcately branching from base, glabrous (var. *glabra*) or sparingly hairy (var. *pilosa*), especially on internodes; leaves $\frac{1}{3}$ to $\frac{1}{2}$ as long as internodes, short-petiolate, asymmetrical at base, oblong-elliptic or rarely obovate, 5–10 mm long, 2–6 mm wide, obtuse, serrulate (especially at apex), glabrous or sparsely hairy beneath; stipules subulate, usually dentate at base. Cyathia solitary in bifurcations, approximate only at summit due to reduced internodes; cyathium infundibular, up to 0.75 mm long and up to 1 mm in diameter, with triangular slightly tridentate lobes; nectaries 4, transversely oblong, below with subequal weakly 2–3-lobed white appendages narrower than nectary; styles filiform, ca. 0.5 mm long, deeply bifid; schizocarp truncate-ovoid, 1.5–2 mm long, trisulcate, with obtusely keeled cocci; seeds oblong, 1–1.2 mm long, tetrahedral, obtusely ribbed, grayish, smooth, with small papillae when ripe (visible only under magnification), without appendage. June–September. (Plate XXIV, Figure 2.)

Rocks and stony slopes, in gravels of riverbanks, sands, fallow lands and roadsides. — European part: Bl. (Kherson and Nikolaev in the south), Crim. (near Evpatoriya), L. Don, L. V. (Volga delta); Caucasus: Cisc., Dag., W. Transc. (near Kutaisi), E. Transc.; W. Siberia: Alt.; E. Siberia: Ang.-Say. (environs of Krasnoyarsk and Minusinsk), Dau.; Far East: Ze.-Bu. (along the Amur in the west), Uss.; Centr. Asia: Ar.-Casp. (Mangyshlak Peninsula), Balkh., Dzu.-Tarb., T. Sh., Syr D., Pam.-Al. (only in Zeravshan River valley). Gen. distr.: Dzu.-Kash., Mong., Jap.-Ch., introduced into Centr. Eur. Described from wild specimens in Berlin. Type in Berlin.

Note. Only the glabrous variety occurs in Europe. The differences between the European *E. humifusa* Willd. and the Asian *E. pseudo-chamaesyce* Fisch. et Mey., pointed out by D. I. Litvinov, have not been confirmed. The habitats of this single species in Asia and Europe might indicate its derivation in Asia and its later introduction into Europe.

154. *E. chamaesyce* L. Sp. pl. (1753) 455; M. B. Fl. taur.-cauc. I, 369, III, 322; Ldb. Fl. Ross. III, 558; Boiss. in DC. Prodr. XV, 2, 34; Fl. or. IV, 1088; Hegi, Ill. Fl. V, 1, 145. — *Chamaesyce vulgaris* Prokh. in Tr. Kuibysk. Bot. Sada, I (1941) 8, nomen altern. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 131, 4750. — Exs.: Fl. exs. austro-hung. No. 44; G.R.F. Nos. 2572, 2573.

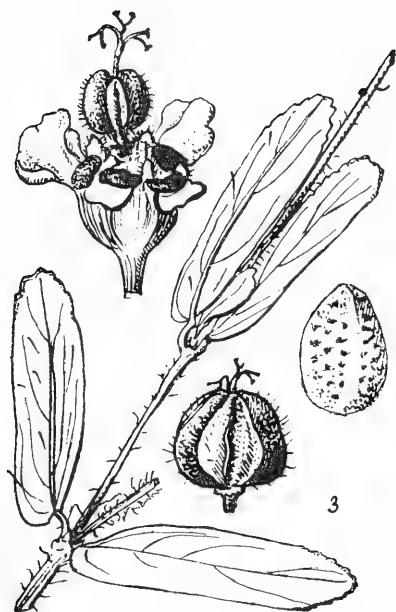
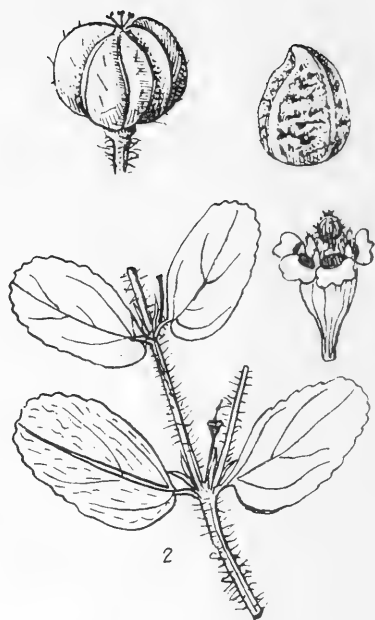
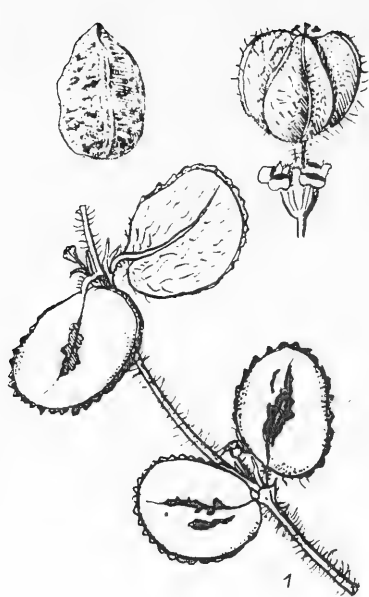


PLATE XXV. 1 — *Euphorbia canescens* L.; 2 — *E. chamaesyce* L.; 3 — *E. turcomanica* Boiss.; 4 — *E. anisopetala* Prokh.

Annual plants, glabrous or sparsely hairy; root thin, vertical; stems few, 5–20 cm long, thin, creeping, many times furcately branching from base; leaves $\frac{1}{3}$ to $\frac{1}{2}$ as long as developed internodes, with petioles only 1–1.5 mm long, strongly asymmetrical, sometimes short-cuneate at base, obovate or orbicular-oblong, 3–9 mm long, 2–6 mm wide, rounded or even slightly emarginate at apex, more or less crenate-serrate or rarely subentire; stipules subulate, 0.5–1 mm long, usually dentate at base. Cyathia solitary in bifurcations, more or less approximate only at summit of stem; cyathium broadly campanulate, 0.8–1.2 mm long, ca. 1 mm in diameter, glabrous outside, hairy inside, with very small lobes; nectaries transversely linear, depressed, below with subequal, entire or shortly 3-lobed (rarely subbicornate) white appendages as wide as to two times wider than nectary; styles up to 0.5 mm long, bifid; schizocarp truncate-ovoid, 1.5–2 mm long, 2–2.5 mm wide, trisulcate, glabrous, with obtusely keeled cocci; seeds ovate, 1–1.2 mm long, tetrahedral, reddish at first, later brownish-gray, obtusely ribbed, irregularly and transversely rugose at faces, convex-inflated at base, without appendage. June–September. (Plate XXV, Figure 2.)

Dry stony slopes, weedy places, fallow lands and pastures. — European part: V.-Don (only along the Volga at Volsk), Transv. (along the Volga at Marksshtadt), Bl., Crim., L. Don (along the Volga at Krasnoarmeisk), L. V. (Volga delta); Caucasus: Cisc. (rarely), Dag., W., E. and S. Transc. **Gen. distr.:** Med., Bal.-As. Min. Described from S. Europe. Type in London.

155. *E. canescens* L. Sp. pl. (1762) 652; M. B. Fl. taur.-cauc. I, 368. — *E. Chamaesyce* var. *canescens* Steud. Nomencl. ed. 1, I (1840) 324; Boiss. in DC. Prodr. XV, 2, 35. — *Chamaesyce canescens* (L.) Prokh., Obz. moloch. Sr. Azii (1933) 19, nomen altern. — Ic.: Cavan. Ic. pl. Hisp. I (1791) tab. 36; Sibth. et Sm. ("E. Chamaesyce") Fl. Graeca, tab. 461; Rchb. Ic. Fl. Germ. V, tab. 131, f. 4751; Prokh. l. c. tabl. 2.

Annual plants, more or less canescent and densely soft-hairy; root thin, vertical; stems few, 5–15(20) cm long, thin, creeping, many times furcately branching from base, spreading-hairy at apex; leaves $\frac{1}{3}$ to $\frac{1}{2}$ as long as internodes, short-petiolate, strongly oblique-rounded at base, suborbicular or rarely obovate, 3–7 mm long, 2.5–5 mm wide, obtuse or emarginate, entire or crenate, rather thick (slightly rugose above when dry); stipules subulate, more or less dentate. Cyathia solitary in bifurcations, more or less approximate at top of branches; cyathium infundibular, 0.75–1.25 mm long, ca. 1 mm in diameter, villous-hairy inside, with triangular-oblong lobes; nectaries 4, transversely oblong, depressed, below with entire or shortly 3-lobed white appendages nearly as wide as nectary to twice as wide; styles 0.3–0.4 mm long, bifid; schizocarp truncate-ovoid, 1.5–2 mm long, trisulcate, with obtusely keeled cocci, more or less pubescent; seeds ovate, 1–1.25 mm long, tetrahedral, obtusely ribbed, with outer faces ca. 0.7 mm wide, reddish at first, later whitish or brown-gray, transversely rugose, with irregularly interwoven wrinkles, convex-inflated below, without appendage. June–August. (Plate XXV, Figure 1.)

Stony slopes in steppes and ravines, sometimes as a weed in cotton crops. — Caucasus: E. and S. Transc., Tal.; Centr. Asia? Balkh. (SW), 492 T. Sh., Syr D., Pam.-Al., Mtn. Turkm. **Gen. distr.:** Med., Bal.-As. Min.? Arm.-Kurd.? Iran. Described from Spain. Type in London.

Note. From the time of Linnaeus the differences between *E. canescens* and *E. chamaesyce* have not been recognized because of the occurrence of transitional forms between the two. It is fairly feasible to unite these taxa, but considering their wide geographical separation in the USSR (except for Transcaucasia) we are purposely refraining from doing so in order to focus further attention on them.

156. *E. turcomanica* Boiss. Tent. Euph. (1860) 13; Boiss. in DC. Prodr. XV, 2, 34; Fl. or. IV, 1087. — *Chamaesyce turcomanica* (Boiss.) Prokh., Obz. moloch. Sr. Azii (1933) 21, nomen altern. — Ic.: Prokh. l. c. tabl. 3.

Annual plants, more or less pubescent or rarely glabrous, glaucous; root rather thick; stems few, creeping, 5–15 cm long, gradually thinning, from the thickened and hardened base many times furcately branching; leaves $\frac{2}{5}$ to $\frac{2}{3}$ as long as internodes, subsessile, strongly asymmetrical (with auricle at one side) at base, linear-elliptic, 5–7 mm long, 2–3 mm wide, often curved, obtuse, entire or hardly dentate at apex, thick (rugose above when dry); stipules subulate, sometimes 2–3-lobed. Cyathia solitary in bifurcations, more or less crowded at ends of branches; cyathium infundibular, ca. 1 mm in diameter, villous outside, glabrous inside, with small triangular lobes; nectaries 4, transversely oblong, with unequal white appendages below: the 2 outer appendages as wide as nectary or wider, the 2 inner narrower or even absent; styles very short (0.2–0.3 mm long), bifid; schizocarp truncate-ovoid, 1.5–1.8 mm long and wide, trisulcate, with obtusely keeled cocci, more or less spreading-villous; seeds oblong, 1.2–1.5 mm long, 0.5–0.7 mm wide, 2–2½ times longer than wide, tetrahedral, acutely ribbed, concave at faces, with few, subregular, transverse wrinkles and furrows, truncate or even slightly impressed at base, acuminate at apex. May–October. (Plate XXV, Figure 3.)

Sands or stony steppes, often saline soils. — Caucasus: E. Transc. (Mugan Steppe), Centr. Asia: Ar.-Casp. (Mangyshlak, western part), T. Sh. (NW), Syr D., Pam.-Al. (W.), Amu D., Kyz. K., Kara K., Mtn. Turkm. Gen. distr.: Iran. Described from Turkmenia, from the shores of the Caspian Sea. Type in Leningrad.

157. *E. anisopetala* Prokh. in Izv. Glavn. Bot. Sada SSSR, XXIX (1930) 550. — *Chamaesyce anisopetala* Prokh. l. c. nomen altern.; 493 Prokh., Obz. moloch. Sr. Azii, 23. — Ic.: Prokh. l. c. tabl. 4.

Annual plants, pale green or even slightly glaucescent; root thin; stems few, prostrate at base then ascending, many times furcately branching, thin; leaves $\frac{1}{3}$ to $\frac{1}{2}$ as long as internodes, short-petiolate, asymmetrically rounded at base, linear-elliptic, 9–15 mm long, 2–4 mm wide, often curved, obtuse, more or less serrate, usually glabrous, 1-nerved; stipules subulate, 2-lobed at base. Cyathia solitary in bifurcations, more or less crowded at ends of branches; cyathium infundibular, ca. 2 mm in diameter, glabrous, with triangular ciliate lobes; nectaries transversely oblong, with unequal white appendages below: the outer two petaloid, elongate, 3 to 4 times longer than width of nectary, generally 2–3-lobed, the inner two distinctly smaller, hardly longer than width of nectary, usually entire; styles filiform, ca. 1 mm long, deeply bifid, reddish; schizocarp truncate-ovoid, 1.5–2 mm long,

2–2.5 mm wide, faintly trisulcate, with obtusely keeled cocci, more or less spreading-hairy; seeds whitish, ovate, 0.9–1.2 mm long, $1\frac{1}{2}$ to 2 times longer than wide, orbicular-tetrahedral, obtusely ribbed, only slightly transversely pitted-rugose, with interwoven wrinkles, convex-inflated at base. May–September. (Table XXV, Figure 4.)

Weed, saline soils and cultivated fields. — Centr. Asia: Syr D., Pam.-Al., Amu D., Mtn. Turkm. (Firyuza Gorge). Endemic? Described from Devonabam near Chardzhou. Type in Leningrad.

158. *E. forskalii* J. Gay in Webb u Berth. Canar. III, 3 (1836–1850) 240, excl. syn. *E. thymifolia* Forsk. et var. β , δ . — *E. aegyptiaca* Boiss. Cent. Euph. (1860) 13; in DC. Prodr. XV, 2, 35; Fl. or. IV, 1088. — *Chamaesyce forskalii* (J. Gay) Prokh. comb. nova, nomen altern.

Annual (also perennial) plants, shortly crisp-hairy, branching from base; stems creeping, up to 30 cm long, rather thick, brittle, softly crisp-hairy, strongly branching; leaves from oblique and slightly cordate at base, oblong-elliptic, 7–15 mm long, 3–6 mm wide, 2 to 3 times longer than wide, obtuse, remotely serrate-crenate at apex, with obtuse or mucronate teeth, hairy on both sides or glabrous above; stipules lanceolate, narrowly fimbriate or cleft. Cyathia solitary in bifurcations but forming short dense leafy glomerules or pseudoracemes because of the short internodes of fertile branches; cyathium subsessile, very small (smaller than in 494 *E. chamaesyce*), shortly turbinate-campanulate or subglobular, hirsute, glabrous inside, with ovate fimbriate lobes; nectaries 4, red, transversely elliptic, concave, with obsolete or very narrow petaloid appendages; styles 0.3–0.4 mm long, diverging, bifid; schizocarp 1.5–2 mm long and wide, finely hirsute with appressed curved white hairs, cocci rather acutely keeled; seeds oblong-ovate, tetrahedral, 1.2–1.5 mm long, 0.6–0.8 mm wide, whitish-gray when ripe, with faces irregularly and finely pitted also transversely rugose. May–August. (Plate XXIV, Figure 5.)

Weed among cotton crops. — Caucasus: E. Transc. Gen. distr.: N. Africa. Described from the Canary Islands. Type in London.

Note. The Russian plants differ from the typical *E. forskalii* of Egypt by the developed petaloid appendages of the nectaries, the less pubescent cyathia, and the smaller seeds. Since it is a weed in the cotton fields of the USSR it can scarcely be viewed as a new species! Could this be a strongly developed form of *E. maculata* L.? The seeds must be studied.

159. *E. maculata* L. Sp. pl. (1753) 455, non L. Mant. (1771); Hegi, Ill. Fl. V, 1, 145. — *E. depressa* Torrey in Ell. Sketch, II (1824) 655. — *Chamaesyce maculata* (L.) Small. Fl. southeast. U. S. (1903) 713, nomen altern. — Ic.: Jacq. Hort. Vind. tab. 186; Jacq. ("E. polygonifolia") Coll. V, tab. 13, f. 3; Rchb. Ic. Fl. Germ. V, tab. 131, f. 4852; Hegi, Ill. Fl. V, 1, f. 1757. — Exs.: Pl. Finl. exs. ("E. nutans") No. 2007; Pl. Polon. exs. No. 116; Fl. Ital. exs. No. 606.

Annual plants, crisp-hirsute, with coarse, bristly, straight hairs, approximately as long as stem, stems creeping, 5–15 cm long, strongly branching, thin-cylindrical; leaves short-petiolate, slightly asymmetrical at base, ovate or linear-oblong, 5–9(10) mm long, 2–4 mm wide, rounded or slightly

acuminate at apex, apex in upper leaves serrulate, usually glabrous above, dull green, later reddening, median leaves with orbicular or oblong purple-brown spot, hairy beneath; stipules lanceolate below, subulate above, fimbriate-dentate. Cyathia appearing axillary in bifurcations due to the very short upper internodes, often adjacent in short dense leafy inflorescence like a peduncled pseudoraceme; cyathium campanulate-turbinate, ca. 0.75 mm long, villous outside and inside, entire or incised for only half, with lanceolate ciliate lobes; nectaries 4, transversely elliptic, with truncate or shortly 2-3-lobed, usually light red appendage longer than width of nectary; styles filiform, 0.3–0.4 mm long, deeply bifid, reddish; schizocarp drooping from the beginning, ca. 1.2(1.6) mm long and 1.5 mm wide when
 495 ripe, green, partly reddening, regularly appressed-hairy at all sides, with obtusely dorsally keeled cocci; seeds ovate, tetrahedral, ca. 0.8 mm long, acute, usually pale brown-red, later often gray, with 3–4 transverse straight and parallel furrows (at base of seed sometimes not quite regular) at the 2 outer (0.5 mm wide) faces.

Weed at roadsides and on coastal sands. — Caucasus: introduced into W. Transc. (near Batumi); Far East: introduced into Ussuri (Suchan River valley). Gen. distr.: Atl. Eur. Described from N. America. Type in London.

Family LXXXVII. **CALLITRICHACEAE*** LINDL.

Plants with unisexual and often bisexual or mixed flowers (in one axil bisexual flower, in the other unisexual flower, staminate or pistillate). Flowers small, solitary, without perianth, with 2 opposite scarious bracts rarely ebracteate; unisexual flowers arranged either on different parts of the stem or different parts of its branches; staminate flowers bearing single stamen with 2-locular reniform anther; pistillate flowers with 1 pistil with 4-locular ovary (at first 2-locular, later becoming 4-locular with the development of pseudoseptum); styles 2, filiform; fruit dry, 4-lobed, 4-seeded. Plants submerged in water, floating or terrestrial, annual-perennial, with opposite leaves often crowded in rosette above.

Genus 857.** **CALLITRICHE**† L.

L. Sp. pl. (1753) 469

1. Fruits on distinct stalks 3–8 mm long (Caucasus) 7. *C. pedunculata* DC.
- + Fruits sessile or on stalks hardly 1 mm long 2.
2. Plants always submerged in water; leaves transparent, dark green, linear 1-nerved, slightly broadening at base; fruits broadly winged at margin; flowers ebracteate (Plate XXVI, Figures 3, 7.) 8. *C. autumnalis* L.

* Treatment by V.I. Krechetovich.

** Characteristics of the genus correspond with the description of the family.

† From the Greek *calli* – beautiful and *trix*, *trichos* – hair.

- + Plants with submerged leaves and rosette of floating leaves; leaves not transparent, pale green and green, usually 3-nerved, spatulate, tapering at base (sometimes linear and nearly 1-nerved but then tapering at base and not broadening); fruits narrowly winged, or winged only in upper part, or wingless; flowers with 2 falcate bracts. 3.
- 496 3. Fruits flattened-globose, not winged, up to 1.2–1.5 mm wide (wider than long); stigma thick, up to 4–6 mm long, persistent even in fruit (Plate XXVI, Figure 2) 4. *C. polymorpha* Loennr.
- + Fruits ellipsoid, obovoid or obcordate, more or less narrowly winged or wingless above, up to 0.8–1 mm wide (longer than wide); stigma . . . thin, filiform, 1–3 mm long, rapidly falling 4.
- ++ Fruits flattened-globose, more or less broadly winged all around, up to 2 mm wide (Plate XXVI, Figure 10) 6. *C. stagnalis* Scop.
4. Fruits completely wingless, obcordate, small, 0.7–0.8 mm long; plants thin and delicate (N. Far East). (Plate XXVI, Figure 8.) 5. *C. subanceps* V. Petr.
- + Fruits winged, even if only at summit, 0.8–1.2 mm long 5.
5. Stigma as long as fruit, up to 3 mm long; fruits sessile, winged along entire margin of mericarps (Far East). (Plate XXVI, Figure 5.) 2. *C. elegans* V. Petr.
- + Stigma much shorter than fruit, 0.7–2 mm long; fruits winged mainly in upper part 6.
6. Fruits obovoid, orbicular at base; stigma 1–2 mm long, rapidly falling. (Plate XXVI, Figures 1, 4) 1. *C. verna* L. s. str.
- + Fruits obovoid, pyriform at base; stigma hardly 1 mm long, falling when fruit ripening (Kamchatka, Anadyr). (Plate XXVI, Figure 6.) 3. *C. fallax* V. Petr.

Section 1. EUCALLITRICHE Hegelm. Mon. Gatt. Call. (1864) 54. — Plants terrestrial or half submerged in water; leaves with well-developed stomata at surface, opaque, with 2 lateral nerves in addition to midrib. Flowers bracteate; fruit more or less strongly united at the center.

1. *C. verna* L. Fl. Suec. ed. 2, II (1755) 2, emend. Loennr. Obs. crit. pl. Suec. (1854) 19; Samuels. in Veröffen. Geobot. Inst. Rüb. III (1925) 618 (descr. Loennr.) et 623; V. Petrov in Fl. Yugo-Vost. V and in Maevsk., Fl. Sr. Ross. ed. 6, 468; Turcz. Fl. baic.-dah. I, 421; Sokolovskaya in Tr. Petergof. Est.-Nauchn. Inst. VIII, 157 and 168, fig. 56; Grossg., Fl. Kavk. III, 40; B. Fedch., Rast. Turk. 560, ex p.; Kom., Fl. pol. Kamch. II, 298; Hulten, Fl. Kamtsch. III, 122, ex p. — *C. verna* γ. *vernalis* Schmalh., Fl. I (1895) 565 (incl. ff.); Kryl., Fl. Alt. 441. — *C. latifolia* Gilib. Exerc. phyt; II (1792) 421. — *C. pallens* Goldb. in Mem. Soc. Nat. Mosc. V (1817) 118, M. B. Fl. taur.-cauc. III, 6. —
- 497 *C. palustris* L. Sp. pl. (1753) 969, ex p.; Litv. in Maevsk., Fl. Sr. Ross. ed. 5 (1917) 207, ex p. — *C. palustris* ssp. *verna* Schinz et Thell. Kryl., Fl. Zap. Sib. VIII (1935) 1882. — *C. palustris* ssp. *caespitosa* Kryl., ibid. 1883. — *C. vernalis* Kütz. in Linnaea, VII (1832) 175; Ldb. Fl. Ross. II, 1, 121; Rupr. Fl. Ingr. 379. — Ic.: Samules. l. c. 609, f. 1e; Sokolovskaya, l. c. fig. 5b; V. Petr. in Fl. Yugo-Vost. fig. 472, A.

Annual plants, 3–50 cm long; leaves pale green, more or less dense, with rounded-notched teeth, usually forming infundibular-submerged rosette on surface of water; submerged leaves either spatulate like the terrestrial (f. *fontana* Kütz.) or more or less linear (f. *stellata* Hoppe), all leaves 3-nerved, rarely (when plants completely submerged in water) all leaves narrowly linear and 1-nerved (f. *angustifolia* Hoppe); both types, the one with spatulate 3-nerved leaves and the one with linear 1-nerved leaves, are represented also on small terrestrial forms (f. *caespitosa* Schultz in the first case, f. *minima* Hoppe in the second). Flowers usually unisexual and then the staminate flowers in upper whorls on stem, sometimes irregularly bisexual and then flowers in 2 whorls: one of mixed flowers neighboring either of staminate or pistillate flowers, rarely all flowers bisexual (A. Sokolovskaya, l. c. 156); fruits on short but distinct stalks, obovoid, up to 0.8–1 mm wide, mericarps narrowly winged mainly along upper margin; stigmas filiform, up to 1–2 mm long, falling long before ripening of fruit. Fl. June–September. (Plate XXVI, Figures 1, 4.) Type in London.

Ditches, backwaters, oxbow-lakes, bogs, damp coastal places. — European part: everywhere, rarely in Bl. and L. Don (in the northern part and in Krasnoarmeisk); Caucasus; W. Siberia; E. Siberia; Far East: Kamch., Okh.; Centr. Asia: Ar.-Casp., Balkh., Dzu.-Tarb., T. Sh. Gen. distr.: Europe, Japan, Manchuria, C. and S. China, N. America, Iceland, Greenland. Described from Sweden. Type in London.

2. *C. elegans* V. Petr. in Izv. Glavn. Bot. Sada, XXVII, 3 (1928) 360; Kom., Fl. pol. Kamch. II, 299. — *C. verna* Kom., Fl. Man'chzh. II (1904) 696, non L. — *C. verna* ssp. *elegans* A. Sokol. in Tr. Peter. Est.-Nauchn. Inst. VIII (1932) 161, f. 5a; Kom. and Alis., Opredel. r. Dal'nevost. kr. II (1932) 712, tab. 214. — *C. vernalis* Korsh. in Tr. B. S. XII, 8 (1892) 338, non Kütz. — Ic.: Sokolovskaya, l. c.; Kom. l. c.

Annuals. Species resembling the preceding, leaves same in shape, all spatulate (f. *spathulifolia* V. Petr.) or linear (f. *submersa* V. Petr. — plant completely submerged), with corresponding terrestrial forms — spatulate-leaved (f. *caespitosa* V. Petr.) or linear-leaved (f. *terrestris* V. Petr.), sometimes leaves heterophyllous with spatulate floating and linear submerged leaves (f. *heterophylla* V. Petr.) 498 or consisting of only 1 floating rosette as the result of decay of the lower part of stem (f. *stellata* V. Petr.); stems up to 30 cm long. Distinguished from the previous species by the sessile fruits 0.8–1 mm long, with mericarps narrowly winged along entire margin (and not only in upper part), wing wider above; stigmas long, up to 3 mm, thin, not falling immediately, persistent at the beginning of development of fruits. Fr. June–August. (Plate XXVI, Figure 5.)

In stagnant or lagging water, ditches, pits, oxbow-lakes, as well as bogs (between hummocks). — E. Siberia: Dau. (E.); Far East: Ze.-Bu., Uss., Sakh., Kamch. Gen. distr.: Mongolia (E.), Manchuria, Japan (N.). Described from Suchan River. Type in Leningrad.

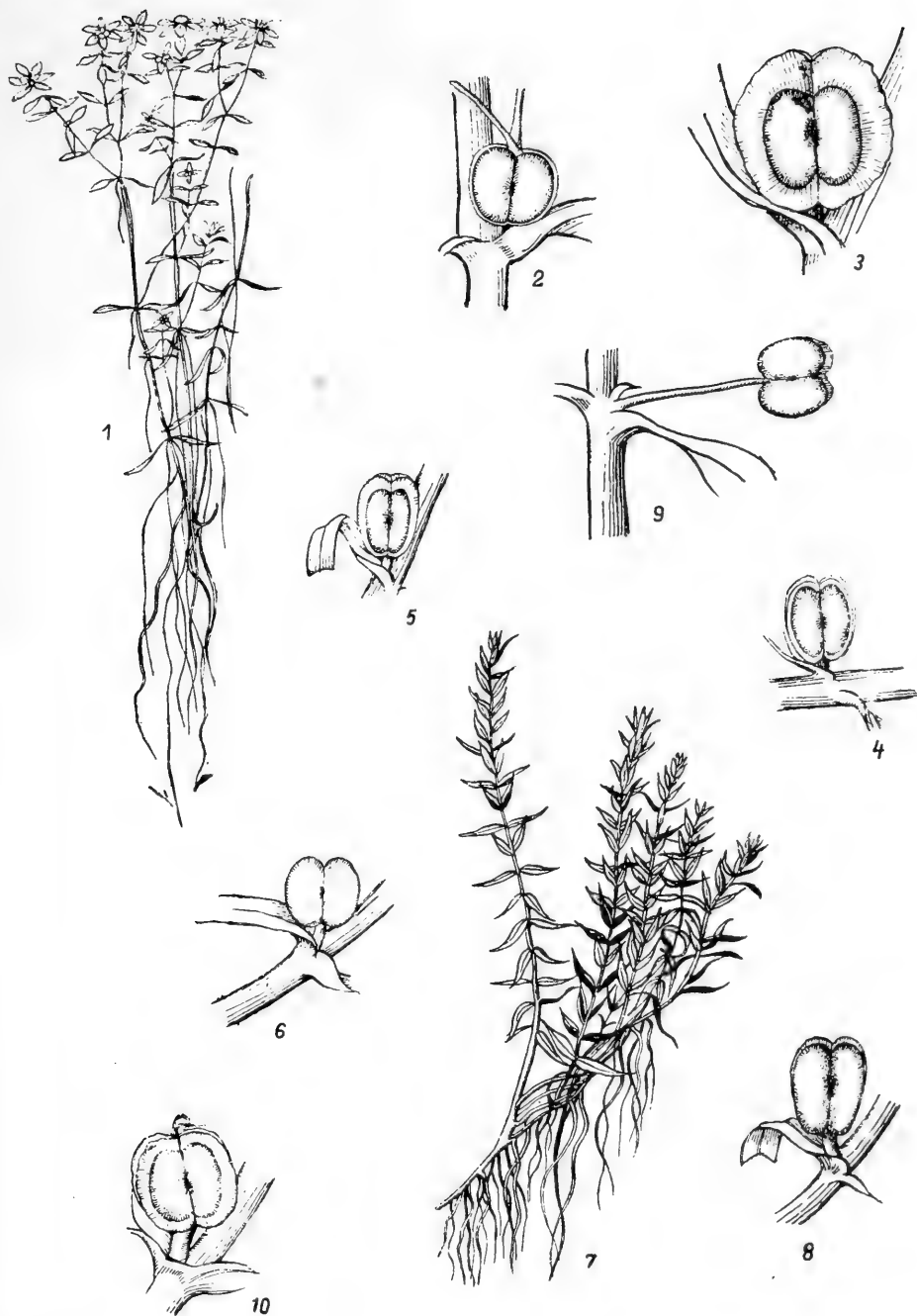


PLATE XXVI. 1, 4 — *Callitriche verna* L.; 2 — *C. polymorpha* Loennr.; 3, 7 — *C. autumnalis* L.; 5 — *C. elegans* V. Petr.; 6 — *C. fallax* V. Petr.; 8 — *C. subanceps* V. Petr.; 9 — *C. pedunculata* DC.; 10 — *C. stagnalis* Scop.

3. *C. fallax* V. Petr. in Izv. Glavn. Bot. Sada, XXVII, 3 (1928) 360; Kom., Fl. pol. Kamch. II, 299.

Annual plants delicate and short, up to 10 cm long, half-submerged or terrestrial forms, pale green, stems filiform; upper leaves oblong-spatulate or spatulate-obovate, the lower linear. Fruits obovoid, 0.8–1.2 mm long, on short distinct stalks, pyriform and slightly inflated at base, mericarps narrowly winged above; stigmas very short, up to 1 mm long, persistent in fruit. Fr. July–September. (Plate XXVI, Figure 6.)

Riverbanks, pools in bogs, damp forests and meadows. — Far East: ? Uss. (Ternei creek?), Kamch. Gen. distr.: N. Japan (Nagasaki). Described from near Shchapino in Kamchatka. Type in Leningrad.

Note. The Ussuri plant (from Ternei creek) differs from the type by its fruits being half as long. Further observation is required.

4. *C. polymorpha* Loennr. Obs. crit. pl. Suec. (1804) 19; Samuels. in Veröffen. Geobot. Inst. Rübel, III (1925) 617–618; V. Petr. in Fl. Yugo-Vost. V, 680 and in Maevsk., Fl. Sr. Ross. ed. 6 (1933) 468. — *C. stagnalis* Ldb. Fl. Ross. II, 1 (1844) 121; A. Sokolovskaya in Tr. Petergof. Est.-Nauchn. Inst. VIII, 167, ex p.; Grossg., Fl. Kavk. III, 40, non Scop. — *C. kützingii* Rupr. Fl. Ingr. (1860) 378. — *C. verna* Grossh., Fl. Kavk. III (1932) 40, p. min. p. — *C. verna* α . *stagnalis* Schmalh., Fl. I (1895) 365, ex p.; Kryl., Fl. Alt. 440. — *C. verna* δ . *hamulata* Schmalh. l. c. — *C. palustris* Rupr. Fl. Ingr. (1860) 376, ex p.; Litv. in Maevsk., Fl. Sr. Ross. ed. 5 (1917) 207, ex p. et quoad var. *stagnalem* Rupr. — *C. palustris* ssp. 501 *stagnalis* Kryl., Fl. Zap. Sib. VIII (1935) 1882, non Schinz et Thell. — Ic.: Samuels, l. c. 609, f. 1, d.

Annual green plants, 4–30 cm long; leaves thin, with acutely notched teeth, a flat rosette of leaves lying on surface of water; submerged leaves usually linear, leaves above water spatulate (f. *aquatilis* Soo), periodically flooded places the lower leaves also spatulate or lanceolate (f. *limicola* Soo = f. *heterophylla* Sokol.?), sometimes plant completely submerged, then stems up to 50 cm long and all leaves sublinear, only the upper slightly spatulate (f. *pseudofluitans* Soo), sometimes plant terrestrial with short reduced stems and shortly linear leaves (f. *terricola* Soo). Fruits flattened-globose, up to 1.2–1.5 mm wide, wider than long, on hardly distinct stalk, not winged; stigmas thick, up to 4–6 mm long, persistent in fruit. May–September. (Plate XXVI, Figure 2.)

Ditches, backwaters, oxbow-lakes, bog. — European part: all regions except L. V. and L. Don (S.). W. Siberia; E. Siberia: Yenisei (Nikulina); Caucasus: Ciscaucasia (W.). Gen. distr.: N., Centr. and S. Eur. Described from Sweden.

5. *C. subanceps* V. Petr. in Izv. Glavn. Bot. Sada, XXVII, 3 (1928) 359; Kom., Fl. pol. Kamch. II, 300. — *C. verna* Hulten Fl. Kamtsch. III (1929) 122, ex p. non L. — *C. vernalis* Rgl. et Tiling in Mem. Soc. Nat. Mosc. XVII (1859) No. 112, non Kütz.

Annuals, thin and delicate, pale green, 10–20 cm long; plants entirely submerged in water, with elongate internodes, and linear leaves (f. *submersa* V. Petr.) narrowly lanceolate or leaves in floating rosette and

linear when submerged (f. *heterophylla* V.Petr.); sometimes plant terrestrial with reduced stems and linear leaves (f. *terrestris* V.Petr.). Fruits obcordate-ovoid, 0.7–0.8 mm long, orbicular at base, short-stalked, wingless; stigmas falling rapidly. Fr. July–August. (Plate XXVI, Figure 8.)

Shallow waters near shores, pools in bogs and damp places. — Arctic: Arc. Sib., An.; E. Siberia: Dau. (E.), Lena-Kol.; Far East: Ze.-Bu., Uda, Okh., Kamch. Endemic. Described from the mouth of the Korenevskaya River in Kamchatka. Type in Leningrad.

6. *C. stagnalis* Scop. Fl. carn. ed. 2 (1772) 251 (s. str.); Samuels. in Veröffen. Geobot. Inst. Rübel, III (1925) 613–614. — Ic.: Samuels, l. c. 609, f. 1, b; Beger in Hegi, Ill. Fl. Mitt. Eur. V, 1, f, 1905, a–f. — Exs.: Fl. exs. austro-hung. No. 3880.

Annual green plants, submerged or submerged-floating, up to 40 cm long; all leaves opaque, obovate or oblong-ovate, spatulate, the lower often oblong 502 and sublinear-oblong, the upper orbicular-obtuse. Fruits globose or slightly flattened-globose, up to 2 mm wide, wider than long, on short distinct stalks, broadly winged along entire margin of mericarps; stigmas persistent. Fr. April–July. (Plate XXVI, Figure 10.)

Lake waters, backwaters, pits. — European part: Balt. (Kaliningrad); Caucasus: W. and E. Transc., Tal. Gen. distr.: England, Iceland, Scand. (nearly up to the Arctic circle), W. and Centr. Eur., Med., N. and E. Africa, As. Min., India, C. China. Described from Carniola (Istria).

7. *C. pedunculata* DC. ex DC. et Lam. Fl. Fr. IV (1085) 414; Boiss. Fl. or. II, 756; Grossg., Fl. Kavk. III, 39.

Annual pale green floating or coastal aquatic plants, up to 30 cm long, appearing also in terrestrial forms; lower leaves linear, the upper oblong-obovate, semiopaque, rounded-obtuse, with elongate petioles. Fruits subglobose, very narrowly winged-rimmed all round, on 3–8 mm long stalks; stigmas short, falling. Fr. May–June. (Plate XXVI, Figure 9.)

Pools in bogs in the maritime belt. — Caucasus: Tal. (Lenkoran and its environs and Shagola-Kyudzha). Gen. distr.: Atl. Eur., Med. Described from Montpellier, France. Type in Paris.

Section 2. PSEUDOCALLITRICHE Hegelm. Mon. Gatt. Call. (1864) 61. — Plants always submerged in water; leaves transparent, nearly without stomata on their surface, 1-nerved. Flowers ebracteate; fruit united only at the middle part and therefore furrowed nearly up to axis.

8. *C. autumnalis* L. Fl. Suec. ed. 2, II (1755) 4, emend. Whlb. Fl. lapp. (1812); Ldb. Fl. Ross. II, 1122; Shmal'g., Fl. I, 366; Litv. in Maevsk., Fl. Sr. Ross. ed. 5, 208, VII, 157, 158 and 167; Kryl., Fl. Zap. Sib. VIII, 1883; Kom., Fl. pol. Kamch. II, 297. — *C. palustris* β. *bifida* L. Sp. pl. (1753) 969. — *C. hermaphroditica* L. Cent. I pl. (1755) 31. — *C. angustifolia* Gilib. Exerc. phyt. II (1792) 421. — *C. virens* Goldb. in Mem. Soc. Nat. Mosc. V (1817) 119; Rupr. Fl. Ingr. 480. — *C. hamulata* Ldb. Fl. Ross. II, 1 (1844) 121, non Kük. —

lc.: Samuels. in Veröffen. Geob. Inst. Rübel, III (1925) 609, f. 1a; Syreishch., Ill. Fl. Mosk. gub. II, 345; Berger in Hegi, Ill. fl. Mitt. Eur. V, 1, f. 1803, a-f. — Exs.: Dörf. No. 5263.

Annual bright green aquatic plants, 5–80 cm long; all leaves submerged, transparent, linear, slightly broadening at base, shortly bidentate at apex, with 1 strongly protruding nerve. Flowers ebracteate; fruit large, globose, up to 5.5 mm in diameter, subsessile, with broadly winged mericarps; stigmas falling. Fr. July–September. (Plate XXVI, Figures 3, 7.)

Lakes, oxbow-lakes, lagging water. — European part: all regions except the Crimea and L. V. (only at Krasnoarmeisk on the Volga); W. Siberia; 503 E. Siberia; Far East; Centr. Asia: Balkh., Pam.-Al. Gen. distr.: N. Eur., Centr. Eur. (Denmark and N. and C. Germany), Greenland, N. Am., S. Am. (Bolivia). Described from Sweden.

Order 25. **Sapindales** LINDL.

For characteristics see page 5 of Volume V.

Family LXXXVIII.* **BUXACEAE** DUMORT

Flowers in heads or spicate inflorescences, monoecious, unisexual, with simple regular perianth of 3–6 lobes; staminate flowers with 4 or many free stamens, with or without rudimentary ovary; pistillate flowers without staminodes, with 3-locular, rarely 2- or 4-locular ovary and free styles persistent in fruit; ovules 2 or 1 in each cell, pendulous, anatropous; fruit a capsule dehiscent by valves, or berrylike; seeds with straight central embryo and usually with fleshy endosperm. Evergreen shrubs, rarely trees or herbs, with simple usually opposite or sometimes alternate exstipulate leaves.

Key to Genera

1. Shrubs or trees, with opposite entire leaves 859. *Buxus* L.
- + Evergreen procumbent grasslike shrubs with alternate leaves
 858. *Pachysandra* Mchx.

Genus 858. **PACHYSANDRA** ** Mchx.

Mchx. Fl. bor.-amer. (1803) 277

Inflorescence (in the Russian species) terminal, spicate, with few pistillate flowers and numerous staminate ones below. Flowers without corolla

* Treatment by A.I. Poyarkova.

** From the Greek *pachys* – thick, wide, and *andros* – man, referring to the staminate flowers.

and disk; staminate flowers with 2–3 bracts and 4 opposite sepals, stamens 4, opposite sepals, attached under the rudimentary ovary; pistillate flowers with several (up to 8) bracts and sepals indistinguishable from bracts, with 3-locular ovary; fruit indehiscent, fleshy (?), berrylike, with 2 or 1 seed in each cell. Evergreen procumbent shrubs.

There are 2 more species in addition to the Russian, one from SW China and the other from the southeastern states of the USA.

04 1. *P. terminalis* S. et Z. in Abh. Acad. Münch, IV, 2 (1845) 142; Baill. Monogr. Buxac. 57; Müll.-Arg. in DC. Prodr. XVI, 21; Makino et Nemoto, Fl. japon. ed. 2, 664; Sugawara, Ill. Fl. Saghal. III, 1269. — Ic.: Sugaw. l. c. tab. 579.

Low perennial shrubs up to 20 cm high, evergreen, glabrous, with herbaceous green decumbent-ascending stems; leaves arranged in 2–3 layers at a distance of 3–7 cm from each other, 5–10 adjacent, alternate leaves in each layer; petioles $\frac{1}{2}$ to $\frac{1}{4}$ as long as blades, blades usually oblong-rhombic or oblong-obovate, up to 6 cm long, 3–4 mm wide, strongly dentate in upper part, teeth obtuse or acute. Inflorescence terminal, racemose, 2–3 cm long, dense; staminate flowers with 2–3 bracts and 4 larger ovate sepals, 3–4 mm long, 2.5–3 mm wide; filaments 3 times longer than sepals, thick; rudimentary ovary 4-angular, half as long as sepals; pistillate flowers with 2 styles, spirally twisted at apex; fruit ovoid-globulose, 9–11 cm [mm?] long, 3-horned, indehiscent, commonly with 1 seed in cell; seeds brown, shiny, 5 mm long, 2–2.5 mm wide, acuminate above. Fl. beginning of May. (Plate XVI, Figure 6.)

Shady stony slopes. — Far East: Sakh. (southern part). Gen. distr.: Jap.-Ch. Described from Japan. Type in Leningrad.

Economic importance. Sometimes the variegated form — var. *variegata* Mann. — is grown as an ornamental plant.

Genus 859. * **BUXUS**

L. Sp. pl. ed. 1 (1753) 983

Inflorescences axillary, forming capitate spikes, with numerous staminate flowers and 1(2–3) pistillate at summit; flowers without corolla and disk; staminate flowers with 1 bract and 4 opposite sepals arranged in regular pairs, stamens 4 attached under the rudimentary ovary; pistillate flowers with few, usually 4–7, bracts and similar sepals, with 3-locular ovary and short thick styles; fruit an ovoid, 3-horned capsule, dehiscing into 3 bicornute (as the result of splitting of the persistent styles) valves; seeds shiny, with endosperm. Shrubs or trees, evergreen with opposite entire leaves.

The Russian species belong to the section *Eubuxus* Baill., which includes apparently some 20 species distributed mainly in SE Asia, the Mediterranean area (2 species), including the Caucasus, the European part of the Atlantic, 505 and in Socotra Island and Madagascar which have one species each. The other sections, sometimes regarded as separate genera, are as follows: *Tricera* Baill. in the West Indies and *Buxella* V. Tiegh. in Africa.

* From the Greek *puxos* — the name used by Aristotle and Theophrastus for this plant.

Economic importance. The wood of *Buxus* is greatly valued for its very fine and even texture, attractive yellow color, compactness and durability; it is hard as bone, easily split, and is widely used in carpentry, cabinet-making, and panel engraving, in addition to many other uses including wind instruments (clarinets, flutes), horns, combs, bobbins, yardsticks, rulers, buttons, etc. The leaves are considered poisonous for cattle. The bark and leaves contain a number of alkaloids. The leaves and branches may be used as a brown dye for animal fibers. In former times the bark and leaves were used in medicine in Europe and the Caucasus for their diaphoretic and emetic properties.

Fossils of the genus *Buxus* are very rarely found.

B. sempervirens L. in the Sarmatian deposits of Bes. (Lipkany); Chauda deposits (upper Pliocene) of Guria.

1. Rudimentary ovary in staminate flowers column-like, $\frac{2}{3}$ to $\frac{4}{5}$ as long as inner sepals 1. *B. colchica* Pojark.
- + Rudimentary ovary short, $\frac{1}{3}$ to $\frac{1}{2}$ as long as inner sepals 2.
2. Carpels [valves] 10–14 mm long, 5.5–7(8) mm wide, with 2–3 mm long horns; leaves of fertile shoots (24)27–35 mm long, 10–14 mm wide 2. *B. hyrcana* Pojark.
- + Carpels [valves] 7–9 mm long, 4–6 mm wide, with 1.5(2) mm long horns; leaves usually smaller, 15–20(25) mm long.
- **B. sempervirens* L.
1. *B. colchica* Pojark. in Refer. rabot Biol. otd. AN for 1945 (1947)
7. — *B. sempervirens* M. B. Fl. taur.-cauc. II (1808) 395, non L.; Ldb. Fl. Ross. III, 2, 583, p. p.; Boiss. Fl. or. IV, 1144, p. p.; Medved., Der. i kust. Kavk. (1919) 252, p. p.; Grossg., Fl. Kavk. III, 40 p. p.; Exs. G. R. F. No. 1788; Fl. cauc. exs. No. 162.
- exs. No. 162.

506 Shrubs or trees, 8 rarely 12–16 mm [sic] high, with erect stem covered with light grayish-yellow smooth bark; branches many, dense, densely leafy, shoots tetrahedral, green, pubescent, at least the juvenile ones; leaves coriaceous, glabrous, slightly inturned at margins, dark green above, shiny, with numerous close furcately branching nerves, pale green and dull beneath, often with loose epidermis, with 1 very prominent midrib; blades very variable in shape and size, mostly elliptic or ovate-elliptic with ratio of length to width: 2–2.5:1, rarely narrowly elliptic with ratio of length to width about 3–3.5:1, terminal leaves with ratio even 4–5:1, all usually obtuse at apex, often emarginate, rarely acute or mucronate, cuneately tapering at base, mostly (17)20–25 mm long and (7)10–12 mm wide, up to 27(30) mm long and 15 mm wide only on sterile shoots, very rarely leaves as large as 27–30(35) mm long and 14–15 mm wide; leaves on small-leaved specimens (13)15–20 mm long and (5)8–11 mm wide and on sterile shoots not larger than 23 mm; petioles short (1–3 mm), canaliculate above, pubescent at margins. Flowers sessile, greenish, in axillary capitate spikes consisting of numerous staminate flowers below and 1(2–3) pistillate above, sometimes pistillate flowers abortive; staminate flowers with 1 bract at base and 2 pairs of sepals connate at base, outer sepals greenish-brown, broadly membranous at margin, markedly concave, the inner sepals petaloid, slightly longer than the outer, 2–2.5 mm long, 2 mm wide, obovate to



PLATE XXVII. 1-*Buxus hyrcana* Pojark.; 2-*B. colchica* Pojark.; 3-*Ilex aquifolium* L.; 4-*I. hyrcana* Pojark.; 5-*I. colchica* Pojark.

orbicular; stamens 2 to 3 times longer than sepals; rudimentary ovary column-like, thickened-capitate above, with 4 vertical furrows corresponding to the 4 filaments, (1.5)1.75–2 mm long, i. e., $\frac{2}{3}$ to $\frac{4}{5}$ as long as inner sepal; pistillate flowers with 4–7 squamiform calycine lobes; ovary with 3 large tubercle-like nectaries above between styles; styles half as long as ovary, with large 2-lobed glandular-villous stigmas; capsule firmly coriaceous, ovoid-globose, valves with nerves 8–9.5 mm long, 4.5–5 mm wide, horns usually 1.5 mm, rarely 2 mm long; seeds 5–6 mm long, black, shiny, oblong-elliptic, bilaterally compressed below, with small white appendage at apex. Fl. March–April, Fr. from August. (Plate XXVII, Figure 2.)

Forming evergreen underwood in beech and mixed forests, very rarely in coniferous, not extending higher than 1,500–1,600 m above sea level. Preferring well-protected and moist places, especially along flowing waters. The best growth is obtained on soils with large mixture of humus. —

Caucasus: W. Transc. Gen. distr.: Bal.-As. Min. (Lazistan). Described from Petskirkii ravine near Sukhumi (G. R. F. No. 1788). Type in Leningrad.

509 Note. By all accounts, the report of Medvedev (1879) on the occurrence of *Buxus* near Tbilisi, Saguram Range, Nukha District, Zurnabad and Gandzha refers to cultivated plants. The author never repeated this report (in *Der. i kust. Kavk.*, for example). In this context it is not clear to which species *B. arborescens* Güldenst (Reise in Russl. I, 1787, p. 419) is referred — *nom. nudum*, a name given to the *Buxus* which Güldenst saw during his journey from Tbilisi to Alazan.

2. *B. hyrcana* Pojark. in *Refer. rabot Biolog. otd. AN for 1945* (1947)
7. — *B. sempervirens* C. A. M. *Enum. pl. cauc. casp.* (1831) 205, non L.; *Ldb. Fl. Ross.* III, 2, 583, p. p.; *Boiss. Fl. or.* IV, 1144, p. p.; *Medved.*, *Der. i kust. Kavk.* (1919) 252, p. p.; *Grossg.*, *Fl. Kavk.* III, 40, p. p.

Shrubs; distinguished from the preceding species by the following characters: less branching plants with shoots less densely leafy; leaves larger, usually (24)27–35 mm long, 10–14 mm wide, on sterile shoots 35–45 mm long and 14–19 mm wide; small-leaves specimens rarely occurring, but sometimes leaves 19–27 mm long and (6)9–11 mm wide, blades oblong-ovate-lanceolate or ovate-elliptic or narrowly elliptic, the ratio of length to width 2.5–2.75:1, rarely narrower or wider, widest usually below middle, rapidly angustate-cuneate at base, very gradually tapering upward, obtuse and often emarginate at apex, rarely leaves ovate and rounded-cuneate at base; sepals 2–4 mm long, hairy, (often some hairs occurring on midrib at lower side of leaf). Both absolute and relative sizes of the rudimentary ovary smaller than in *B. colchica*, $\frac{1}{3}$ to $\frac{1}{2}$ as long as inner sepal, 1–1.5 mm long. Staminate flowers usually larger; inner sepals 2.5–3 mm long and wide; fruit larger than in the other species; valves 10–14 mm long, 5.5–7(8) mm wide, horns (1.5)2–3.5(4) mm long. Fl. March–April, Fr. from August. (Plate XXVII, Figure 1.)

Forming evergreen underwood in hornbeam forests, *Parrotia persica* C. A. M. and *Quercus castaneifolia* C. A. M., in the lower and central mountain belts. The thickets of *B. hyrcana* are not large and known in the USSR only from a few points. — Caucasus: Tal. Gen. distr.: Iran. (mountainous part of the Caspian). Described from Shommol River in Gilan. Type in Leningrad.

**B. sempervirens* L. Sp. pl. (1753) 983; Boiss. Fl. or. IV, 1144, p. p.; DC. Prodr. XVI, 19; Hegi, Ill. Fl. V, 1 (1925) 204.— Ic.: Rchb. Fl. Germ. (1841) f. 4808; Hegi, l. c. f. 1806, 1810, 1812.— Exs.: Rchb. Fl. Germ. exs. No. 4808; Schulz, Herb. Norm. nov. ser. No. 915; Fl. Gall. et Germ. exs. No. 927; Billot, Fl. Gall. et Germ. exs. No. 639; Fl. Graec. exs. No. 697 et bis.

510 Shrubs; small trees up to 8 m high or ca. 1 m high shrubs, with suckers and dense erect branches, and with green, densely leafy shoots bilaterally pubescent when young; leaves short-petiolate, glabrous on both sides, ovate, oblong-ovate or elliptic, rarely narrowly elliptic, usually 15–23 mm long, 5–11 mm wide, rarely larger than 25–30 mm long and 12–13 mm wide. Pistillate flowers usually 1 in inflorescence, with 2–7, usually 5–6 calycine lobes, sometimes flowers abortive; outer pair of sepals in staminate flowers strongly concave, nearly conduplicate, inner sepals 2–2.5 mm long, obovate or orbicular, obtuse-rounded or rarely acute at apex; stamens 1.5–2 times longer than inner sepals; rudimentary ovary short, 0.75–1.5 mm long, $\frac{1}{3}$ to $\frac{1}{2}$ as long as inner sepals; fruit ovoid-globulose or globose, valves 7–10 mm long, 5–6 mm wide, horns 1.5(2) mm long. Fl. March–April.

Cultivated in southern part of Europe, mainly in the Crimea. Described from S. Europe. Type in Leningrad.

Economic importance. One of the few evergreen, dycotyledon plants in the European ornamental wood assortment. The low shrubs are planted on footpaths, seedbeds and flowerbeds, the higher shrubs and treelike forms are planted on lawns singly or in groups. *Buxus* has been under cultivation since antiquity, especially in Rome where the gardeners were already skilled in cutting them into decorative forms. Many forms are known, among them: the treelike *f. arborescens* L. (*B. arborescens* Mill.), *f. angustifolia* Loud. (*B. angustifolia* Mill.) and *f. rotundifolia* Baill.; with variegated leaves *f. argentea* Loud. and *f. aureo-marginata* Loud.; the low-growing nearly semishrubs known only in cultivation *f. suffruticosa* L. (*B. suffruticosa* Mill.); the dwarf, small-leaved, nearly always sterile form, commonly used as hedges, or the same low form but with acute leaves *f. myrtifolia* Loud. (*B. myrtifolia* Lam.) or with linear leaves *f. rosmarinifolia* Baill.; there is also a weeping form *f. pendula nummulariifolia* hort.

Note. The natural distribution area of *B. sempervirens* L. combines two parts: 1) the western part which encompasses Algeria, N. and E. Spain, S. and C. France up to Swiss Jura and Alsace in the north, and 2) the eastern part where the wild-growing plants are from Istria and Macedonia, across N. Greece up to Asia Minor, where they inhabit three isolated islands: in the southwestern corner, northeast in Bithynia and in Trebizond. In Europe the plants grow in exposed and moderately dry areas, mainly as the undergrowth of leafy forests but also on taluses and dry plots protected by shrubs or even without this protection.

511 It is possible that *B. sempervirens* is not monotypic. In any case it should be noted that *Buxus* is generally represented in the eastern part of its distribution area by more narrowly leaved forms with thinner leaves with blades not so firmly coriaceous as in the western populations.

Family LXXXIX. **EMPETRACEAE** * LINDL.

Flowers unisexual or bisexual, small; sepals squamiform; petals as many as sepals alternate to them; stamens as many as petals or 6, 4 of which opposite sepals; anthers globular, ovate or elliptic, 2-locular (in bisexual flowers often 1-locular), opening longitudinally; ovary superior, sessile on fleshy disk, 3-, 6-, 9- and 12-locular; ovules solitary, ascending; style 1; stigmas stellate, with rays corresponding to number of carpels; fruit fleshy, berrylike, situated in dry perianth, 3-, 6-, 9- or 12-celled, walls of cells firm, woody; seeds solitary, ascending; embryo gradually tapering above, buried in fleshy-aqueous albumen. Small shrubs, with ericoid evergreen exstipulate leaves, with small axillary flowers.

Note. In the opinion of the author this family should be placed near the Ericaceae.

Genus 860. **EMPETRUM** ** L.

L. Sp. pl. (1753) 1022

Flowers axillary, solitary (rarely 2, 3), sessile on short shoots, unisexual or bisexual, in monoecious or dioecious plants; calyx 3-sepalous, enclosed by imbricate scalelike bracts, scarious-coriaceous, fimbriate-ciliate at margin, 2-6 (often 4 or 5) in number, the inner two colateral and equal; sepals slightly connate at base, coriaceous, sometimes partly colored; corolla of 3 petals alternating with sepals; stamens 3 (very rarely 4 or 6), alternating with petals; style short, sometimes indistinct; stigma rayed, 6-, 9-, 12-branched into lobate segments; fruit berrylike, globulose, flattened or oblong, black, red, purple or cherry-colored, 6-, 9-, 12-celled, usually edible, with watery slightly sweetish juice; cells 1-seeded, together with seeds forming hard drupes. Small shrubs, with branches decumbent, appressed to earth; leaves semiwhorled or whorled, rarely alternate, dense, 512 recurved or nearly proximate at margins, beset with long hairs enclosing the remaining space between leaves, leaves in lower part of branch always reflexed. In all holarctic species the inner (lower) walls of the epidermal cells are mucilaginous. Flower buds formed in the fall.

Economic importance. In many parts of the North (Anadyr, Chukchi, Kamchatka, shores of the Sea of Okhotsk, Greenland and elsewhere), the natives mix the crowberries with dried fish and seal oil and prepare one of their favorite dishes which they call "tolkushka." In the treeless parts of the Arctic the plants are used as fuel.

1. Ripe berries light or dark cherry color, dirty gray when dry, semi-transparent; flowers unisexual; dioecious plants 7. **E. kardakovii** V. Vassil.
- + Ripe berries black 2.
2. Flowers unisexual; dioecious plants 3.
- + Flowers bisexual 5.

* Treatment by V. N. Vasil'ev.

** The word *empetrum* consists of two words: *en* - on and *petros* - rock, stone, referring to the habitat being on rock or stone.

3. Filaments $1\frac{1}{2}$ times longer than petals; branches long, biennial, dark purple, dark cherry-colored or chestnut-brown, shiny; leaves narrowly elliptic 1. *E. nigrum* L. (s. str.).
- + Filaments $2\frac{1}{2}$ times and longer than petals; leaves linear 4.
4. Leaves smooth, shiny; branches short, firmly appressed to earth, with dense leaves 3. *E. kurilense* V. Vassil.
- + Leaves dull, usually rugose; branches elongate with loosely disposed leaves 2. *E. sibiricum* V. Vassil.
5. Leaves elliptic or oblong-elliptic; filaments up to twice as long as petals 4. *E. hermaphroditum* (Lge.) Hagerup
- + Leaves different in shape; filaments at least $2\frac{1}{2}$ times longer than petals 6.
6. Leaves linear, dull, when dry usually rugose, green 5. *E. androgynum* V. Vassil.
- + Leaves dilated at base, narrowly ovate, shiny, smooth, old leaves dark purple, the young pale or yellow-green . . . 6. *E. arcticum* V. Vassil.

Section 1. NEO-EMPETRUM V. Vassil. in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 3. — Berries black, often with glaucescent bloom.

Series 1. Dioica V. Vassil. — Flowers unisexual, dioecious plants.

1. *E. nigrum* L. Sp. pl. (1753) 1022; Pall. It. III, 33, 286; Ldb. Fl. Ross. III, 555, ex p. — *E. procumbens* Gilib. Exerc. Phyt. (1792) 393. — Ic.: Pax in Engl. u. Prantl, Pflanzenfam. III, 5 (1896) f. 8, A-9.

513 Shrubs, with long procumbent strongly branching stems sometimes reaching 1 m and more in length; young branches more or less densely dotted with sessile or papilliform, amber or white glands; the annual, strongly elongating branches pale lilac; biennial or triennial branches, dark purple, dark cherry, chestnut-brown, often shiny, later turning brown; leaves usually loosely disposed, often perpendicular to branches, rarely at right angles, narrowly elliptic, rarely narrowly ovate, ratio of length to width 2.5:4. Staminodes often present in pistillate flowers; bracts 5 (rarely 4); sepals squamiform, spoon-shaped, sometimes pinkish at base, 1.1–1.6 mm long, 0.8–1.2 mm wide; petals pinkish or dark red, with very distinct claws, especially in staminate flowers; filaments 1.5–2, rarely 2.5 times longer than petals; styles nearly inconspicuous; stigmas with 6–9-toothed lobes; fruit black with glaucous bloom, rarely white (f. *leucocarpum* Aschers. et Magn.), a berry containing 6–9 stones, each 2–2.3 mm long, 1.2–1.4 mm wide. Fl. May–June, Fr. August.

Mostly in the forest zone of peat bogs, pine forests, rock crevices, exposed rocks, usually in masses. — Arctic: Arc. Eur. (rarely); European part: Kar.-Lap. (rarely); Dv.-Pech., Lad.-Ilm., U. V., V.-Kama, U. Dnp., Balt.; W. Siberia: Ob, U. Tob. Gen. distr.: Scand. (Finland up to 68°N; Sweden, from the south up to the line slightly more northern than the line of Vaner and Vatter lakes; Norway), Atl. Eur. (England, Iceland), E. and SE Greenland, N. Am. (E. Canada). Described from Europe. Type in Sweden.

2. *E. sibiricum* V. Vassil in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 3. — *E. nigrum* auct. (non L.). — *E. nigrum* f. *japonicum* R. Good. in Journ. Linn. Soc. XLVII (1927) 515, ex p. — *E. nigrum* var. *asiaticum* Nakai ex Ito in Tokyo Bot. Mag. XLVII (1933) 895, nom. nud.; Nakai Fl. Sylv. Koreana, XXI (1936) 109, ex p. quoad pl. URSS. — *E. asiaticum* Nakai, Fl. Sylv. Koreana, l. c. p. 110. — *E. albicarpha* Sugawara, Pl. of Saghal. (1937) 226. — *E. nigrum* var. *japonicum* f. *albicarphum* (Sugawara) Honda, Nom. Pl. Jap. (1939) 194. — *E. pubescens* V. Vassil. l. c. — *E. stenopetalum* V. Vassil. l. c. — Ic.: Nakai, l. c.

Shrubs, with long procumbent strongly branching stems sometimes reaching 1 m and more in length; young branches beset with sessile papillae [?], amber, rarely whitish, sometimes more or less densely covered with rufous or whitish tufts of short crisp hairs; leaves usually loosely disposed, reflexed (f. *genuina*) or perpendicular to branches (f. *pubescens* mihi et f. *stenopetalum* mihi), linear, when dry rugose and dull, rarely
514 smooth and shiny (var. *asiatica* Nakai), dark green (f. *genuina*) or pale green. Flowers pinkish or dark red; staminodes often present in pistillate flowers; bracts (4)5(6), rarely 2 (var. *asiaticum* Nakai); sepals sometimes pinkish at base, 1.0–1.6 mm long, 0.7–1.6 mm wide; petals 1.5–2.4 mm long, 0.5–1.3 mm wide, with more or less distinct claw in staminate flowers, in the pistillate gradually tapering at base, usually denticulate above; filaments 2.5–3.5(4) times longer than petals; perigynium 0.8–1.2 mm long, 0.3–0.6 mm wide; style short, often nearly inconspicuous; fruit globose, black, rarely white (*E. albocarpha* Sugawara l. c., *E. nigrum* var. *japonicum*, f. *albicarphum* (Sugawara) Honda), a berry with (7)8–11 stones, stones 1.5–2.5 mm long, 0.9–1.5 mm wide. Fl. May–June, Fr. end of August.

Mostly in the forest zone: sphagnum bogs, sphagnum mounds, sand bars, dunes, larch, pine and spruce forests, coastal meadows, rarely in the alpine zone or in tundras. Sometimes forming uninterrupted cover. — Arctic: Arc. Sib. (lower reaches of Kolyma River), Chuk., An.; W. Siberia: Ob, Alt.; E. Siberia: Yenis., Ang.-Say., Lena-Kol., Dau.; Far East: Kamch. (Commander Islands), Okh., Ze.-Bu., Uda, Uss., Sakh. **Gen. distr.:** Mongolia (N.), Jap.-Ch. (Manchuria, Korea, Japan), Aleutian Islands, Ber. (Alaska, Aleutian Islands), Canada. Described from Uda District near Nikolaevsk-on-Amur (Far East). Type in Leningrad.

Note. It is possible to separate *E. nigrum* var. *asiaticum* Nakai, from the Japan-China part of the distribution area, as an independent species as Nakai did (*E. asiaticum* Nakai), but in the USSR there is not enough material to make such a decision, the material from Korea and Cheju Island does not fit the diagnosis of this species. The same applies to *E. albicarpha* Sugawara, about which there is no material at hand.

3. *E. kurilense* V. Vassil. sp. nova in Addenda XIII, 744. — *E. nigrum* auct. Fl. insul. Kuril., non L.

Diocious shrubs, with short branches appressed firmly to ground, hidden in lichen-moss turf; the annual branches covered with strict glands and rufous crisp hairs; leaves dense, linear, obtuse, usually reflexed, the older shiny, 2.5–5 mm long, 1 mm wide. Flowers solitary on short branches,

covered at base with 4 squamiform, very approximate, fimbriate bracts; sepals broadly ovate, cartilaginous, transparent at margins, entire; petals pink or purple, ovate, faintly dentate above, ca. 3 mm long, 1.5 mm wide; stamens with flattened filaments, ca. 8 mm long, anthers purple, 2-locular, ca. 1 mm long; fruit black.

- 515 Open places, on moss and lichen covers. — Far East: Sakh. (Kurile Islands). Endemic. Described from Kunashir Island. Type in Leningrad.

Series 2. *Hermaphrodita* V. Vassil. — Flowers bisexual.

4. *E. hermaphroditum* (Lge.) Hagerup in Dansk. Bot. Ark. Bd. 5, 2 (1927). — *E. nigrum* g. *hermaphroditum* Lge. in Meddelelser om Grönland, H. 3 (1880) 18. — Ic.: Hagerup, l. c. 2, 13.

Shrubs, usually with short strongly branching stems firmly appressed to the ground; young branches dotted with sessile or papilliform, usually amber glands; biennial and triennial branches terra-cotta or brick in color, rarely chestnut-brown, the annual branches greenish to terra-cotta; leaves usually dense (with the exception of shade specimens), usually perpendicular to branches or ascending, narrowly elliptic or narrowly ovate, ratio of length to width 3:4. Flowers bisexual, firmly covered at base with 4 squamiform imbricate bracts; sepals spoon-shaped, 1.3–1.6 mm long, 1.2–1.5 mm wide; petals without distinct claw, pinkish, (1.6)2.2–2.3(2.7) mm long, 1.1–1.5 mm wide; stamens 3, rarely 4 or 6; filaments 2–2.5 times longer than petals; anthers short, broadly elliptic, usually 1-locular; perigynium 0.8–1.0 mm long, 0.5–0.7 mm wide; style short; stigmas with 9-toothed lobes; fruit black berry with 6–8(9) stones, each (1.6)1.8–2.2(2.5) mm long, 1.2–1.3 (1.5) mm wide. Fl. and Fr. somewhat later than the preceding.

Mostly in the tundra belt along mountain tops, rarely in forests or turf bogs. Commonly in large numbers. Fruiting better than the preceding species. — Arctic: Nov. Z. (with Kolguev), Arc. Eur., Polar Urals, Arc. Sib. (Yamal Peninsula); European part: Kar.-Lap., Dv.-Pech., Lad.-Ilm. (rarely), V.-Kama (alpine tundra belt above timberline in N. and C. Urals). **Gen. distr.:** Spitsbergen, E. and SE Greenland, Scand. (N. Sweden, N. Norway), Atl. Eur., England (rare), Iceland. Described from Greenland. Type in Denmark.

5. *E. androgynum* V. Vassil. in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 3. — *E. nigrum* auct. (non L.). — *E. nigrum* f. *japonicum* R. Good in Journ. Linn. Soc. XLVII (1927) 515, exp. — *E. nigrum* var. *asiaticum* Nakai ex Ito in Tokyo Bot. Mag. XLVII (1923) 895, nom.; Nakai, Fl. Sylv. Koreana, pars XXI (1936) 109, exp. — *E. asiaticum* Nakai, l. c. exp. — *E. subholarcticum* V. Vassil. l. c. — *E. polare* V. Vassil. l. c.

- 516 Shrubs, with short, firmly appressed or long procumbent, strongly branching loose branches; young branches more or less densely covered with rufous tufts of short crisp hairs and dotted (sessile) or papillose with usually amber, rarely whitish glands, or only glandular without hairs; biennial and triennial branches brick-colored or chestnut-brown, the annual ones yellowish; leaves linear (ratio of length to width 4:10), rugose when

dry, rarely smooth. Flowers pinkish or dark red, bisexual; bracts (4)5; sepals squamiform, spoon-shaped, sometimes pinkish, 1.3–2.4 mm long, 1–2 mm wide; petals 1.7–2.8 mm long, 0.9–1.5 mm wide, gradually tapering at base, rarely with short claw; filaments 3–3.5(4) times longer than petals; anthers 2- or 1-locular; perigynium 0.6–1.2 mm long, 0.4–0.7 mm wide; style short, generally indistinct; fruit black globose berry with (6)7–10 stones, stones (1.4)1.8–2.5 mm long, 1.1–1.9 mm wide. Fl. May–June, Fr. at end of August, beginning of September.

Mostly in the forest zone, in broadleaved and pine forests, stony taluses, sands, sphagnum bogs and moist tundra. Frequently growing in abundance.—Arctic: Arc. Sib., Chuk., An.; Caucasus: Cisc., Dag., W. Transc.; W. Siberia: all regions; E. Siberia: all regions; Far East: Kamch., Okh., Ze.-Bu., Uda, Sakh. **Gen. distr.:** Mong. (NW), Jap.-Ch., Ber. (SW Alaska, Unalaska), N. Am., Alaska, Arctic and more moderate latitude up to Greenland and Labrador. Described from Irkutsk Region near Suvorka in Kirensk District. Type in Leningrad.

Note. The Caucasian bisexual form has more in common with the Siberian *E. androgynum* than it has with *E. hermaphroditum* and for this reason we are referring it to *E. androgynum* as var. *caucasicum* V. Vassil. More study of this form is required.

6. *E. arcticum* V. Vassil. in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 4.

Shrubs, with relatively short, strongly branching stems appressed to ground; young branches dotted (sessile) or papillose with usually amber (sometimes whitish) glands, sparingly covered with rufous-crisp hairs; biennial and triennial branches brick- or terra-cotta-colored; leaves dense, nearly always completely covering stem, the uppermost ascending, below more spreading, the lower retrorse, all shiny, dark purple but the young light or yellow-green, dilated at base (especially in the older leaves), glandular at margin, 3–6(7) mm long, ratio of length to width 3:4.8. Flowers bisexual, covered at base with 4 imbricate squamiform bracts denticulate at margins; sepals broadly ovate, markedly concave, light brown, pale at margin, subentire; petals dark purple, obovate, slightly broadened above, ca. 3 mm long, 1 mm wide, without distinct claw; filaments flattened, ribbon-like, 6–6.5 mm long; anthers ca. 1 mm long and wide, 2- or if 1-locular then ca. 0.5 mm wide; stigmas 10-lobed; fruit globose black berry, medium or large in size (up to 8 mm in diameter), with 9 stones ca. 1.6 mm long, 1.5 mm wide. Fr. at end of August.

Dry stony-pebbly and sandy soils. — Arctic: Arc. Sib. (basin of Olenek River and the lower reaches of the Kolyma River), Chuk., An. **Gen. distr.:** Canadian Archipelago, Labrador. Described from Baffin Island. Type in Leningrad.

Section 2. *PALEO-EMPETRUM* V. Vassil. in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 4, nom. — Fruit in various shades of red.

Series 1. *Holarctica* V. Vassil. — Mature leaves not hairy-pubescent. In addition to the Russian species, the N. American *E. purpureum* Raf., *E. atropurpureum* Fern. et Wieg., and *E. eamesii* Fern. et Wieg. belong to this series.

7. *E. kardakovii* V. Vassil. in Referaty rabot Otd. Biol. Nauk AN SSSR (1946) 4.

Shrubs, with prostrate, strongly branching stems; young branches more or less densely covered with rufous or whitish crisp hairs and small papilliform, amber, rarely whitish glands; biennial or triennial branches chestnut-brown; leaves rather dense, mostly retrorse, rarely perpendicular to branches, ratio of length to width 3:4, when dry nearly without wrinkles, pale green. Flowers unisexual (dioecious plants, pinkish or dark red, sometimes staminodes present in pistillate flowers; bracts 4; sepals squamiform, spoon-shaped, 1.0–1.7 mm long, 1.0–1.2 mm wide; petals 2.0–2.5 mm long, 1.1–1.3 mm wide, with rather distinct claw, few-dentate above; stamens 1.1–1.2 mm long, 0.5 mm wide; filaments pale violet or pinkish, nearly twice as long as petals; anthers dark violet; style short or inconspicuous; fruit a globose light or dark-cherry-colored berry (dirty gray when dry), with 10–11 stones 1 mm long, 0.8 mm wide. Fl. May–June, Fr. September.

Dry tundra, on separate spots among blackberry cones. — Far East: Kamch. (N. Kamch. and Commander Islands). *Gen. distr.*: Ber. (Unalaska). Described from Bering Island. Type in Leningrad.

518 Family XC. **ANACARDIACEAE** * LINDL.

Trees or shrubs, with deciduous or evergreen leaves and resinous bark; leaves alternate, rarely opposite, simple or compound, exstipulate or very rarely stipulate. Flower bisexual or unisexual, regular, small, in panicles; sepals 3–5; petals 3–5, usually imbricate, rarely perianth simple; stamens 5 or 10, rarely less or more, situated together with petals at margin of annular disk or at base of ovary; styles 1–5; ovary superior, with 1 or 3–5 free or connate carpels; ovules 1 in each cell, anatropous; fruit a stone or nut; seeds usually exalbuminous or with very thin albumen.

Family of about 60 genera and nearly 600 species, distributed in the tropical and subtropical areas of the world.

Note. There is a wide diversity of sexual types of flowers in this family. Alongside the commonly bisexual flowers there are many cases of polygamous plants, i. e., one plant with bisexual and unisexual flowers, as well as cases of complete or incomplete unisexual flowers predominating both on one plant (transitions from polygamous to monoecious) or on different plants (incomplete or complete dioecism). An example of nearly complete dioecism (only very rare exceptions are known) is the genus *Pistacia* L. and of typical polygamy *Cotinus coggygria* Scop., whereas another species of this genus — *C. americanus* Nutt. — is (according to the literature) dioecious. There are also many cases of such diversity among the genera *Rhus* L. and *Toxicodendron* Mill. where the flowers are of different sexual types not only in subgenera and sections,

* Treatment by I. A. Linchevskii.

but even among individuals of the same species. Understanding of this phenomenon requires large-scale field observation and experiment. Without this knowledge there can be no precise description of the characteristics of most of the species and, subsequently, of the genera and their subdivisions.

Findings of *Anacardium* in the USSR are very few.

A. cf. occidentale uniradiatum Felix in E. Transc. (Apscheron Peninsula).

- Tribe 1. **RHOIDEAE** Engl. in DC. Monogr. phan. IV (1883) 176. —
 Carpels 3, rarely 1 (*Pentaspadon* Hook. f.); styles terminal or lateral,
 free or connate below; ovary superior, 1-locular, very rarely 2–3-locular,
 519 but only with 1 fertile short-stalked ovule attached at base of ovary or to
 the lateral wall beneath apex; stamens arranged in 1 or 2 circles; fruit a
 1-locular, monospermous drupe, sometimes developing from sepals, rarely
 a real pappus. Leaves simple, ternate or pinnate.

Key to Genera

1. Flowers with simple perianth 861. *Pistacia* L.
- + Flowers with double perianth (calyx and corolla) 2.
2. Leaves simple; pedicels of abortive flowers (in fertile panicles long-hairy 862. *Cotinus* Adans.
- + Leaves simple, ternate or pinnate; pedicels of abortive flowers not long-hairy 3.
3. Inflorescence a terminal panicle; fruit small, red, with red glandular hairs and with or without simple ones; plants not poisonous 863. *Rhus* L.
- + Inflorescences lateral, axillary, rarely terminal panicles; fruit large, whitish, glabrous or with simple hairs; poisonous plants 864. *Toxicodendron* Mill.

Genus 861. **PISTACIA** * L.

L. Gen. pl. ed. 5 (1754) 450

Flowers unisexual, dioecious, in lateral axillary panicles; staminate flowers with simple perianth of 2–6 leaves; stamens 5–6; pistillate flowers with simple perianth of 3–11 leaves; staminodes and disk absent; staminate and pistillate flowers subtended by bracteoles larger than perianth and more pubescent, 1 for each flower or for 2–3 ones depending on the position of the flower in the inflorescence; ovary superior, 1-locular; styles short, 3-partite, one lobe of stigma usually larger than the others; fruit a drupe

* The term is derived from the Persian word *pista* or *psta*, as *P. vera* L. is known throughout the East. In early times the word entered the Greek (*pistake*) and Latin (*pistacia*) languages and later all the European languages in more or less varied spellings.

with rather thin pericarp and hard, bony-like endocarp (stone). Trees and shrubs, with deciduous (Russian species) or rarely evergreen leaves; leaves ternate or pinnate, with entire leaflets.

A genus of about 20 species, distributed in the subtropical and tropical parts of the Old and New Worlds.

Of the fossil specimens in the USSR *Pistacia miocenica* Unger (Eocene deposits, Lava of Chernigov Region, A. N. Krasnov, 1911) is the only one on which the data are not completely reliable.

- 520 1. Leaves nearly always ternate, with wingless petioles; fruit large, up to 2 cm long, oblong, tapering 1. *P. vera* L.
+ Leaves paripinnate, with petioles narrowly winged in upper part 2. *P. mutica* F. et M.

1. *P. vera* L. Sp. pl. ed. 1 (1753) 1025; Boiss. Fl. or. II, 5; Engl. in DC. Monogr. phan. IV, 292; M. G. Popov in Tr. po prikl. bot. gen. i sel. XXII, 3, 447; Smol'skii and Smirnov, ibid. XXV, 4 (1931) 221; Kordon in Kul't. Fl. SSSR, XVII, 325.— *P. trifolia* L. l. c. 1025.— *P. narbonensis* L. l. c. 1025.— Ic.: Smol'skii and Smirnov, l. c. t. t. plur.; Kordon, l. c. tab. 60.

Trees (usually many-stemmed) up to 5–7(10) m high, usually with dense subspherical crown, often shrubs; bark on old branches light gray, whitish, on annual shoots gray- or reddish-brown, finely pubescent or glabrous; leaves imparipinnate, nearly always ternate, with 3, rarely 1 or 5(7) leaflets; petioles finely pubescent or subglabrous, wingless or very narrowly marginate; leaflets subsessile, thick, coriaceous, smooth, pale green, glabrous and shiny above, beneath dull, puberulent or subglabrous, broadly elliptic or orbicular-ovate, rarely broadly lanceolate, broadly cuneate to irregularly rounded or subtruncate at base, hardly acuminate at apex, with or without very small mucro, (3)5–11(20) cm long, (3)5–6(12) cm wide. Staminate flowers in dense compound rather broad panicles, 4–6 cm long; leaves perianth (2)3–5(6), oblong, scarious or subscarious, usually unequal, crisp-hairy at margin (more so in upper part), (1)2–2.5(3) mm long; stamens 5–6, subsessile, with anthers 2–3 mm long; pistillate flowers in narrower and looser panicles approximately as long as staminate inflorescences; leaves perianth 3–5(9), oblong, unequal, slightly broader than in staminate flowers, (1)2–3(4.5) mm long, scarious or subscarious, usually (except the innermost), crisp-hairy at margin (more so in upper part); fruit large (usually a few times larger than in other species of the genus), sublinear-lanceolate, narrowly ovoid or broadly ovoid to subglobose, (0.6)0.8–1.5(2) cm long, (0.5)0.6–0.8(1) cm wide, suborbicular or irregularly oval in cross section; pericarp partly separating when ripe, cream colored, cream-yellow, pink, reddish, dark red, dark violet; endocarp (stone) nearly always with oblique base (scar), usually obtusely keeled at one side, splitting or not. Fl. March–May, Fr. July–September. (Plate XXVIII, Figure 1.)

Fine earth, stony and rocky slopes of foothills and low mountains, (450) 700–800–1,500–1,750 (2,000) meters above sea level (Pam.–Al.), mostly in the zone of ephemeral meadows with xerophyllous perennials and in the belt of ephemeral vegetation with separate stands of *Pistacia*, also among a number of other formations of xerophyllous woody vegetation;



PLATE XXVIII. 1 - *Pistacia vera* L., branch with fruit, staminate and pistillate flowers; 2 - *P. mutica* F. et M., branch with staminate and pistillate flowers.

sometimes also occurring in woody-shrub formations on southern slopes. — Centr. Asia: Mtn. Turkm., Syr D., Pam.-Al., T. Sh. Gen. distr.: Iran. (NE). Described from S. Europe (Sicily) from cultivated specimens. Type in London.

Note. Investigation of the racial composition of the wild Central Asian *P. vera* L., which was conducted by the All-Union Scientific Research Institute of Plant Growing and the All-Union Institute of Dry Subtropics, revealed a rather broad diversity of small forms distinguished mainly by the size and shape of the fruits. Taxonomically, they could not be considered more than just forms. The cultivated Mediterranean *P. vera* L. differs very little from the locally escaped Central Asian species, only the leaves, flowers and fruit of the former being larger. The absence of real local *Pistacia* in the Mediterranean area and the strict adherence in all languages to the Persian root of the name corroborate the derivation of the cultivated Mediterranean *Pistacia* from Iran and Central Asia. Reports on this are found in works of ancient Greek and Roman authors. The cultivation of the plant in the Mediterranean area is dated at not less than 2,000 years ago.

V. P. Gorbunova (Problemy Turkmenii, II (1935) 447) recorded finding in Central Asia (Kushka) hybrids between (in the opinion of M. G. Popov) *P. vera* L. and *P. khinjuk* Stocks. After a study of similar (judging by the description) specimens from Kushka, collected by Karpov and Kreitsberg (Gerbarii SAGU in Tashkent), we came to a similar conclusion but thought it more likely that these were hybrids between *P. vera* L. and *P. cabulica* Stocks. Their fruit is very variegated, distinctly an intermediary type between the obliquely oblong fruits of *P. vera* and the compressed, nearly reniform fruits of *P. cabulica*, and the leaves are almost those of *P. cabulica* in size and other measurements.

Is it possible that these forms deserve recognition as a separate species — *× O. popovii* Lincz.?

P. khinjuk Stocks does not occur in the USSR. The report from Kushka obviously refers to the above-mentioned hybrids and the report of Kordon (l. c., p. 325) from Transcaucasia refers to the acute leaved forms of *P. mutica* F. et M.(?). *P. khinjuk* Stocks is not present in the Herbarium of the All-Union Scientific Research Institute of Plant Growing in Leningrad and therefore it is difficult to determine what precisely Kordon
524 meant by this name in the XVIIth volume of "Kul'turnaya flora SSSR."

Economic importance. *P. vera* L., which was widely known and valued in ancient times, is a source of edible fruits, tanning products, resins and wood. The fruits are eaten salted or cooked and also used in making confections and sausage. The seeds contain from 40 to 60% oil which is extracted by pressing and is used in food or for medical purposes. Tannin substances are obtained from galls (caused by two different species of aphids) containing 30–40% tannins which are used in tanning and dyeing (raspberry colors for silks and carpeting, in addition to blacks and blues). There are indications that the leaves contain up to 15% tannides. The resin is obtained by tapping stems and thick branches. The yield of resin in general is not large but considering its value (high-quality paints and nitro-lacquers) a moderate exploitation of natural plants (male trees only!) for resin may prove worthwhile. The natural area of *P. vera* L. in Central Asia consists of about 300,000 ha. It is under cultivation in Central Asia,

the Crimea and Transcaucasia where the harvest is not bad. Its cultivation in many other countries is found profitable (Iran, Syria, Italy, N. America — California). Future prospects for its development in the USSR are huge, especially in Central Asia and the Caucasus. In view of the fact that the natural trees of *P. vera* L. often suffer from illegal cutting, cattle grazing and fires because of insufficient supervision in the remote parts of Central Asia, measures should be taken to protect this subtropical, fruit-bearing and technical wood of such economic value.

2. *P. mutica* F. et M. in Hohenack. Enum. pl. Talysch. (1837) 102; F. et M. in Bull. Soc. Nat. Mosc. IV, 338; Ldb. Fl. Ross. I, 508; Boiss. Fl. or. II, 7, p. p.; Engl. in DC. Monogr. phan. IV, 287; Shmal'g., Fl. I, 210; E. Bush in Mat. dlya Fl. Kavk. III, 8, 14; Vinogradov-Nikitin in Tr. po prikl. bot. gen. i sel. XXII, 3, 179; Grossg., Fl. Kavk. III, 42; Kordon in Kul't. Fl. SSSR, XVII, 322. — *P. terebinthus* M. B. Fl. taur.-cauc. II (1808) 418, non L. — *P. atlantica* DC. Prodr. II (1825) 64, p. p. non Desf. —? *P. khinjuk* Kordon, l. c. 325, non Stocks. — Ic.: Karst. u. Schenk, Veg.-Bild. X (1912) tab. 27; Vestn. russk. fl. III (1917) tab. 1, 2, 4; Kordon, l. c. tab. 59. — Exs.: Herb. Fl. Cauc. No. 35; Dörfler, Herb. Norm. No. 5021.

- 525 Trees 8–10(15) m high, with very dense rounded well developed crown; bark of annual shoots rufous-brown, ash-gray on older branches; leaves paripinnate, with (3)5–7(9) leaflets; petioles pubescent in upper part, narrowly winged; leaflets ovate, orbicular-ovate or narrowly ovate, subsessile, obtuse or acutish at apex, short-hairy along margin and above along midrib, shiny above, dark green, paler beneath, 4–5(7) cm long, 1.5–2.5(3) cm wide. Staminate flowers in dense compound rather broad panicles, 4–6(9) cm long; leaves of perianth (2)4–5(6), oblong, scarious or subscarious, unequal, (1)2–2.5(3) mm long, usually crisp-hairy at margin (more in upper part); stamens 5–6, subsessile, with anthers 2–3 mm long; pistillate flowers in looser panicles 4–6(8) cm long; leaves of perianth 4–7(11), oblong, unequal, much broader than in staminate flowers, (1)2–2.5(3) mm long, scarious or nearly so, usually (except for the inner) crisp-hairy at margin (more in upper part); fruit small, in larger specimens fruiting panicles sometimes pendulous, globose-obovoid, compressed, 0.5–0.7 cm long, 0.5–0.6 cm wide, with inconspicuous mucro above, pericarp reddish when ripe, later becoming blue, oily; endocarp (stone) not splitting. Fl. April, Fr. July, August. (Plate XXVIII, Figure 2.)

Dry slopes of low mountains up to 600–850(1,000) m above sea level (Transcaucasia); often along river valleys, upper terraces, sometimes enduring very saline soils. — European part: Crim. (from Sevastopol to Koktebel'); Caucasus: W. (Novorossiisk area), E. and S. Transc. Gen. distr.: E. Med., Bal.-As. Min., Arm.-Kurd., Iran. (W.). Described from Transcaucasia (Khanlar, former Elenendorf). Type in Leningrad.

Economic importance. Oil suitable for combustion and soap-manufacture is extracted from the fruits, which contain about 60% oil. The fruits are also often used to feed domestic animals (pigs) who graze among the plants in the fall when the fruits are scattered on the ground. The leaves contain 8–15(20)% tannides but often galls are formed so that the tannide content

increases. In the bark and partly in the wood there is a huge quantity of resin which is extracted by tapping the tree. The dried resin is widely known in the Caucasus and in Iran under the name "kevy," and is chewed. The resin of *P. mutica* F. et M. is also used as a substitute for the resin "Dammar" in the lacquer-paint industry to produce nitrolacquers, oil paints and paints for artists (P. L. Senov. *Fistashka kak ob'ekt dlya polucheniya smoly*. Sb. "Rastitel'nye resursy Turkmenii," ed. VIR, 1935).

526 *P. mutica* F. et M. is one of the basic stocks for the cultivation of *P. vera* L. and hence is of interest in fruit-growing in the Crimea, Caucasus and Central Asia. The tree is also ornamental and is grown for this purpose because of its resistance to salt and dryness, its handsome dark green leaves and clusters of fruits reddening in the fall.

Genus 862. **COTINUS*** Adans.

Adans. Fam. pl. II (1763). — *Rhus* L. Sp. pl. ed. I (1763) 267, p. p.

Flowers bisexual and staminate (polygamous plants) yellowish-white or greenish, usually abortive, in large loose terminal panicles; pedicels of abortive flowers much elongating and becoming hairy; bracts lanceolate, deciduous; sepals 5, oval-lanceolate, imbricate, persistent; petals 5, oblong, twice as long as sepals, more or less spreading; stamens 5, shorter than petals, attached below the annular disk; filaments short; anthers shorter than filaments; ovary oblique, sessile, 1-locular, with 3 short lateral styles; fruit small, dry, veined, obliquely obovoid or a reniform drupe with dried pericarp; embryo with flat cotyledons. Trees or shrubs, with yellow wood, peeling bark and pungent juice; leaves deciduous simple, alternate, entire or hardly dentate, glabrous or more or less hairy, with thin petioles.

The genus *Cotinus* is known in the USSR from the Paleocene to the Quaternary period.

Cotinus elliptica Baik. in Paleocene deposits of Amur (Raichikha). — *C. ucrainica* Baik. in Sarmatian deposits of Transcarpathia (Berezinka). — *C. coggygria* Scop. in Sarmatian deposits of the Black Sea area (Amrosievka) in post-glacial tuffs of Ciscaucasia (Mashuk near Pyatigorsk).

1. *C. coggygria* Scop. Fl. Carn. I (1772) 220; Engl. in DC. Monogr. phan IV, 350; C. K. Schn. Laubholz. II, 145; E. Bush in Mat. dlya Fl. Kavk. III, 8, 17; Rehd. Man. cult. trees (1927) 535; Grossg., Fl. Kavk. III, 42. — *C. coggygria* Mill. ex Hegi, Fl. V, 1 (1925) 226. — *Rhus Cotinus* L. Sp. pl. ed. I (1753) 267; Ldb. Fl. Ross. I, 509; Boiss. Fl. or. II, 4; Shmal'g., Fl. I, 209. — Ic.: Engl. l. c. tab. 12, f. 28–32; Engl. u. Pr. Pflanzenfam. III, 5, f. 89, 100; C. K. Schn. l. c. tab. 97; Hegi, l. c., tab. 1821, 1822; Fedch. and Fler., Fl. Evr. Ross. 619. — Exs.: Hayek, Fl. Stir. exs. No. 544; Schultz, Herb. Norm. nov. ser. No. 2146.

* From *cotinus*, as Pliny named one of the shrubs growing in the Apennines from which purple dye was extracted.

Small branching shrubs, rarely small trees, 2–5 m high, with rounded crown; leaves ovate to obovate, 3–8(10) cm long, 2–4(7) cm wide, rounded or slightly emarginate at apex, smooth, glabrous above, usually hairy beneath, with 1–4 cm long petioles. Flowers greenish-white, small, ca. 3 mm in diameter; petals 1.5–2 mm long; fruiting panicles 15–20 cm long, 527 with numerous elongated pedicels of abortive flowers, covered with long spreading reddish or greenish hairs; fruits few in panicle, obliquely obovoid or reniform, greenish, later turning black, 3–5 mm long. Fl. June, July, Fr. August, September.

Dry, often stony slopes and chalk outcrops, forests and shrubby thickets.—European part: M.Dnp., Bl., Crim., L. Don, L. V.(?); Caucasus: Cisc., Dag., W., E. and S. Transc. Gen. distr.: Med. (W. and E.), Bal.-As. Min., Arm.-Kurd., Iran, Ind.-Him., Jap.-Ch. (China: provinces of Hopeh, Hupeh, Kansu, and Yunnan. Described from S. Europe. Type in London.

Note. In the extensive distribution area of *C. coggygria* Scop. there are a number of forms that are closely related, some of which were noted by Engler (Engl. in Bot. Jahrb. I (1881) 403) as: 1) var. *laevis* Engl. (= *Rhus laevis* Wall. in G. Don. Gen. Syst. II (1832) 69); 2) var. *pubescens* Engl.; 3) var. *cinerea* Engl.; 4) var. *velutina* Engl. (= *Rhus velutina* Wall. Cat. (1828) No. 998).

C. americanus Nutt., the second species of the genus, is sporadically distributed in the area near the basin of the Mississippi River in the United States and is very much like the Russian species but its leaves are larger.

Economic importance. This species is of high value for tanning, being a source of high-quality tannin obtained from the leaves, which contain 15–25% tannides. It is also widely cultivated for industrial purposes in the Mediterranean area (especially in Sicily). The successful experiments in growing *Cotinus* which began in the Crimea at the end of the last century and the new attempts at cultivation in other places in the southern part of the USSR indicate that there are huge possibilities of increasing tanning resources by developing plantations of *Cotinus*. The plant is also used in dyeing wood, skins and wool. The yellow wood is utilized for making various articles.

It is also ornamentally grown for its feathery panicles and its leaves which are yellow and purple in the fall. Var. *purpurea* Rehd. is a very decorative plant with intensively purple hairs in the panicles and young reddish leaves.

Cotinus can be recommended for experimental cultivation as one of the components of the second layer of the large field-protecting forest belts in the south of the European part of the USSR.

Genus 863. **RHUS** * L.

L. Gen. pl. ed. 5 (1754) 129, p. p. excl. *Cotinus* Adans. et *Toxicodendron* Mill.

Flowers many, bisexual or unisexual in monoecious or dioecious plants, 528 forming terminal panicles or terminal and lateral compound-spicate inflorescences; bracts lanceolate or oval, deciduous or persistent; sepals 5, usually persistent; petals 5, upright; ovary 1-locular, sessile on a disk;

* Ancient Greek name for unknown shrub.

style terminal, 3-partite; stamens 5, attached below the disk; fruit a small red drupe, globose, slightly compressed, with glandular hairs and sometimes also with simple ones, pericarp more or less thin, endocarp (stone) firm and resinous; embryo with flat cotyledons. Small, non-poisonous trees or shrubs; leaves usually deciduous, alternate, simple, ternate or imparipinnate, usually thin, with rounded or winged petioles.

Only one species of *Rhus* has locally escaped in the USSR, but many naturalized species (American and East Asian) are cultivated as ornamental plants. We shall present two of the more common ones below.

The genus *Rhus* was widespread in the USSR from the Eocene to the Miocene.

Rhus gigantea Pim. in Sarmatian deposits of Black Sea area (Amvrosievka).—

R. lanceolata Bors. in upper Miocene deposits of Sakhalin (Agnevo).—

R. merianii Heer in lower Oligocene deposits of E. Transcaucasia (Darry-Dag).—

R. quercifolia Goepp. in Sarmatian deposits of the Black Sea (Amvrosievka, Krynka).—

R. juglandogene Ett. in Sarmatian deposits of the Black Sea area (Amvrosievka).—

R. sachalinensis Krysht. in Oligocene deposits of Sakhalin (Nainai, upper Due).—

R. turcomanica (Krysht.) Vasil in Eocene deposits of Turkm. (Er-Oilan-Duz).—

Rhus sp. in Oligocene deposits of Balkh. (Ashutas).

- | | | | |
|----|--|----|------------------------------|
| 1. | Leaflets small, 3–6 cm long | 1. | <i>R. coriaria</i> L. |
| + | Leaflets larger, 6–13 cm long | 2. | |
| 2. | Petioles wingless; leaflets whitish-glaucous beneath, finely hairy | | * <i>R. hirta</i> (L.) Sudw. |
| + | Petioles usually winged, sometimes rather broadly so; leaflets brownish beneath densely velutinous-hairy | | * <i>R. javanica</i> L. |

Subgenus 1. Sumac (DC.) C. K. Schn. Laubholzk. II (1907) 153; DC. Prodr. II, 67, pro sect.— Erect shrubs and small trees, with few angular branches. Leaves alternate, pinnate, deciduous; petioles winged or wingless; leaflets sessile; inflorescence paniculate, usually terminal; flowers many, each usually with small lanceolate bract; drupe red, covered with red glandular hairs.

R. coriaria L. Sp. pl. ed. 1 (1753) 265; Ldb. Fl. Ross. I, 509; Boiss. Fl. or. II, 4; Engl. in DC. Monogr. phan. IV, 381; Shmal'g., Fl. I, 210; C. K. Schn. Laubholzk. II, 154; E. Bush in Mat. dlya Fl. Kavk. III, 8, 21; Hegi, Fl. V, 1, 224; Grossg., Fl. Kavk. III, 42.— Ic.: Engl. u. Pr. Pflanzenfam. III, 5, tab. 107; C. K. Schn. l. c. tab. 101, 102; Yakimov and Goncharov in Tr. Tadzh. bazy AN SSSR, VIII, 425, tab. 7.— Exs.: Herb. Fl. Cauc. No. 80; Sennen, Pl. D'Esp. No. 6549.

529 Small, comparatively few-branched trees or often shrubs, 1–3(5) m high; bark on annual shoots gray-brown, scabrous-hairy, on perennial branches brown; leaves 15–18 cm long, imparipinnate, with 9–17 leaflets; petioles

scabrous-hairy, winged in upper part; leaflets scabrous-hairy, sessile, oblong-ovate or lanceolate, largely crenate-serrate, 3–5(6) cm long, (1.5)2–3 cm wide, rounded or broadly cuneate at base, acuminate at apex. Flowers greenish-white, in terminal oblong-conical panicles, sometimes partly in small axillary panicles, subsessile, unisexual, staminate and pistillate flowers in different racemes, staminate flowers in loose longer panicles up to 20–25 cm long; sepals 5, greenish, densely hairy and ciliate outside, orbicular-ovate, ca. 2 mm long, 1–1.5 mm wide; petals 5, whitish, ovate, 2.5–3.5 mm long, ca. 1.5 mm wide; stamens 5, attached at base of a broad disk bearing a rudimentary (undeveloped) ovary; filaments ca. 1.5 mm long; anthers ca. 1.5 mm long; pistillate flowers in smaller dense panicles up to 15 cm long, hardly distinguishable from the male flowers except for the presence of a developed ovary with 3 stigmas and 5 rudimentary small stamens with nearly undeveloped anthers; fruit globose or reniform, 0.5–0.6 cm in diameter, red-brown, densely glandular-hairy. Fl. June–July, Fr. September–October. (Plate XXIX, Figure 1.)

Dry, usually stony slopes in the lower and central mountain belts. In Crim. – stony and rocky slopes of the southern coast, up to ca. 700 m above sea level; in W. Kopet-Dagh and Pam.-Al. – in the upper part of ephemeral vegetative belt at heights of 900–1,700 m above sea level. – European part: Crim. (southern shore from Balaklava to Sudak); Caucasus: W. and E. Transc., Dag., Tal.; Centr. Asia: Mtn. Turkm. (W. Kopet Dag), Pam.-Al. (western part). Gen. distr.: Med. (W. and E., west of Canary Islands, Teneriffe and Madeira), Bal.-As. Min., Arm.-Kurd., Iran. Described from S. Europe. Type in London.

Note. The small forms of *R. coriaria* L. have been insufficiently studied. Known from S. Europe (Sicily) are the varieties – *R. coriaria* L. var. *sumac* Engl. l. c. 383 (= *R. sumac* Targ. Tozz. Oss. dec. VI, 3) distinguished by attenuate-acuminate, narrowly toothed or subentire leaflets.

Because of the botanical and geographical interest and the economic significance of *R. coriaria* L., the species is deserving of detailed taxonomic study.

Economic importance. *R. coriaria* L. is one of the valuable plants for tanning and dyeing; such plants, so-called "leaf tanning agents," contain tannides mainly in the leaves. Together with *Cotinus coggyria* Scop. it was described by Theophrastus, being widely used in ancient times. Russian travelers (Zemledel'cheskii Afganistan (1929) 388) related that in N. Afghanistan *R. coriaria* L. was widely cultivated in gardens because
530 of its leaves which were used to dye silk fabrics, and that these leaves were sold at all markets under the name "bargisum." According to E. V. Vul'f (Khim. tekhn. sprav. IV, 11 (1932) 73, the leaves contain from 13 to 25.5% tannides (in material from the Crimea); according to Yakimov and Goncharov (l. c. 437) from 11.5 to 18.5% reaching the maximum (21%) during budding and flowering (material from Pamir-Alai). The main component part of the tannides of *R. coriaria* L. – tannin – is used in medicine, textile industry, viniculture, dyeing industry. Tannin is also the only source for obtaining gallic acid and pyrogallol. "The entire assortment of tannin production, commencing with pharmaceutical tannin, may be obtained from the leaves of *Sumac* ..." (Yakimov and Goncharov, l. c.). Since the

natural growths of *R. coriaria* L. are insufficient for industrial exploitation on a broad scale, it must be planted. According to Vul'f (l. c.) fairly good results are achieved on pebbly slopes of the southern shore of the Crimea; according to Yakimov and Goncharov (l. c.) in the irrigated conditions of the Stalinabad Botanical Garden of the Tadzhikistan base of the Academy of Sciences of the USSR, *R. coriaria* L. reached 1–1.6 m in height in the first year and 3 m in the second, which indicates the possibility and advantages of its cultivation under irrigation. Owing to the very poor germination of the seeds they should be actively stimulated before sowing. *R. coriaria* L. can withstand winter temperatures of -20° and thus could be cultivated throughout the USSR. Since it can develop root suckers it should be recommended as a forestry measure in improving mountainous areas, i. e., in fixation of precipitous stony slopes.

★*R. hirta* (L.) Sudw. in Bull. Torr. Bot. Club. XIX (1892) 81, non Harv.; C. K. Schn. Laubholzk. II, 153. — *Datisca hirta* L. Sp. pl. ed. 1 (1753) 1037. — *Rhus typhina* Torner in L. Amoenit. Acad. IV (1759) 311; L. Sp. pl. ed. 2, 380; Engl. in DC. Monogr. phan. IV, 378; Rehd. Man. cult. trees (1937) 537; Barkley in Ann. Mo. Bot. Gard. XXIV (1937) 326. — *Schmaltzia hirta* Small, Fl. S.-E. States (1903) 729. — *R. Carolinianum* Mill. Gard. Dict. ed. 8 (1768). — Ic.: Sarg. Silva N. Amer. III (1892) tab. 102, 103; Bull. Soc. Dendr. France (1913) p. 31, 201; Bailey, Stand. Cycl. Hort. 2954; Hegi, Fl. V, 1, tab. 1818–1820.

Small trees, 3–7 m high; young branches, petioles and inflorescences densely pubescent; leaves up to 45 cm long, with 9–27 leaflets; leaflets sessile, lanceolate to lanceolate-elliptic, serrate at margin, whitish-glaucous beneath, usually finely hairy, 6–13 cm long, (1)2–3.5 cm wide, obtuse at base, attenuate-acuminate at apex. Flowers greenish, unisexual, in pyramidal panicles up to 10–20 cm long; pedicels short, ca. 1.2 mm long; sepals orbicular-tetrannular, 1.5 mm long, 0.5 mm wide, hairy outside, ciliate at margin, glabrous inside, persistent; petals lanceolate or oblanceolate, recurved at tip, ca. 3.5 mm long, 1.5 mm wide, hairy, not ciliate, falling; filaments much longer than petals; anthers 1.5 mm long, 0.8 mm wide; fruit 4 mm long, 4.5 mm wide, flattened, red, densely red-hairy. Fl. June, Fr. August.

Locally escaped in N. America (USA and Canada, in the Great Lakes area). Often cultivated as an ornamental in the gardens and parks of the southern part of the USSR.

Economic importance. The leaves of *R. hirta* (L.) Sudw. contain 13 to 25% tannins (ca. 18% in galls), making it an economically important plant for the south of the USSR. It is also of interest as an ornamental because of its beautiful fernlike leaves and clusters of fruit reddening in the fall. American Indians use the bark and bast to stop bleeding, etc. (Barkley, l. c.).

★*R. javanica* L. Sp. pl. ed. 1 (1753) 265; Rehd. et Wils. in Sarg. Pl. Wilson. II, 4, 178; Rehd. Man. cult. trees (1927) 537. — *R. semialata* Murr. in Comm. Götting. VI (1785) 27; Engl. in DC. Monogr. phan. IV, 380. — Ic.: Murr. l. c. tab. 3; Bailey, Cycl. Amer. Hort. (1902) 1530; Bailey Stand. Cycl. Hort. (1916) 2953; Useful, Pl. Jap. II (1895) tab. 383; C. K. Schn. Laubholzk. II, tab. 101, 102 (sub *Rh. Osbeckio*); Hegi, Fl. V, 1, tab. 1816.

Shrubs or small trees up to 8 m high, with broad rounded crown; branches yellowish, smooth; leaves with 7–13 leaflets; leaflets subsessile, ovate to ovate-oblong, 6–12 cm long, acuminate or shortly attenuate-acuminate, largely serrate-crenate, brownish-hairy beneath; petioles distinctly winged, pubescent. Flowers cream-white, unisexual, in loose panicles 15–25 cm long, on ca. 1 mm long pedicels; sepals ovate, short-hairy, ca. 0.5 mm long; petals oblong, 2 mm long, 1 mm wide; fruit subglobose, 0.4–0.6 mm in diameter, orange-red, densely covered with red and white hairs. Fl. August, Fr. September–October.

Locally escaped in SE China, Japan, Hawaiian Islands. Often grown in botanical gardens and parks in the southern regions of the USSR.

Economic importance. A small tree of ornamental value because of its cream-white flowers in large panicles opening at the end of summer. The galls formed on the leaves (causative agent of *Schlechtendalia chinensis* Licht.), known as "Chinese" or "Japanese" galls, contain 58 to 77% tanning properties.

Genus 864. **TOXICODENDRON** * Mill.

Flowers bisexual or unisexual in monoecious or dioecious plants, in pendulous axillary lateral panicles; bracts lanceolate, deciduous; sepals 5, 532 persistent; petals 5, erect; ovary 1-locular, sessile on a disk; style terminal, 3-partite; fruit a rather large globose whitish drupe, slightly compressed, glabrous or sparsely simple-hairy; the middle layer of the pericarp (mesocarp) with much wax, the external layer (epicarp) easily separating from the mesocarp at ripening.

Poisonous trees, shrubs or woody lianas; leaves alternate, ternate or imparipinnate, thin, glabrous or very sparingly pubescent.

The species of this genus are distributed in N. and S. America and E. Asia and should be handled with extreme caution because of their toxic ingredients. In view of the fact that they are often cultivated in botanical gardens we are describing some of the more commonly grown species.

1. Leaves ternate; woody lianas or small shrubs 2.
- + Leaves imparipinnate 3.
2. Leaves nearly always (except very rarely) entire, glabrous beneath but with fascicles of hairs at secondary nerves; fruit covered with small papillae, sparingly-hairy 1. **T. orientale** Greene.
- + Leaves irregularly serrate or dentate, rarely entire, glabrous or sparsely (without fascicles) hairy beneath; fruit usually glabrous, rarely covered with small papillae or short-hairy ***T. radicans** (L.) Ktze.
3. Seeds shallowly notched at base and summit, with more or less distinct longitudinal furrows 4.
- + Seeds not notched, smooth (without furrows) ***T. vernicifluum** (Stokes) Lincz.

* From the Greek toxicon - poison and dendron - tree.



PLATE XXIX. 1 - *Rhus coriaria* L., branch with fruit and flowers; 2 - *Toxicodendron radicans* (L.) Ktze., branch with flowers; 3 - *T. vernix* (L.) Ktze., seeds; 4 - *T. vernicifluum* (Stokes) Lincz., seeds.

4. Seeds shallowly furrowed 2. *T. trichocarpum* (Miq.) Ktze.
 + Seeds deeply furrowed **T. vernix* (L.) Ktze.

Section 1. *EUTOXICODENDRON* C.K. Schn. Laubholz. II (1907) 149. — Woody climbers or small shrubs, with rather thin, elegant branches; flowers in small drooping lateral panicles; leaves alternate, ternate.

- 535 1. *T. orientale* Greene, Leaf Bot. obs. and crit. I (1905) 127. — *Rhus orientalis* C.K. Schn. Laubholz. II (1907) 151; Rehd. Man. cult. trees (1937) 539. — *Rhus Toxicodendron* v. *volubilis* Engl. in DC. Monogr. phan. IV (1883) 394, p. p. quoad specim. asiatica. — *R. Toxicodendron* v. *hispida* Engl. in Bot. Jahrb. XXIX (1900) 433. — Ic.: Bull. Coll. Agric. Tokyo, II (1895) tab. 5, f. 15; Useful, Pl. Jap. II (1895) tab. 488; C.K. Schn. l. c. tab. 98h.

Shrubs or climbers, with more or less hairy (young) branches; leaflets 3 always entire (very rarely irregularly serrate-dentate in young specimens), broadly oval to oblong-ovate, rounded to broadly cuneate at base, short-attenuate or cuneate-acuminate at apex, rarely rounded, glabrous above, partly pubescent beneath (with fascicles of hairs at secondary nerves); terminal leaflet up to 16–18 cm long, up to 12 cm wide, with 2–4 cm long petiolule, lateral leaflets usually irregular (asymmetrical), slightly smaller than the terminal, up to 16 cm long, 9 cm wide, with 0.3–0.5 cm long petiolules. Flowers greenish-white, on 1.5–2 mm long pedicels; sepals triangular-oval, ca. 1.5 mm long, 1 mm wide, glabrous; petals oborbicular-lanceolate, glabrous, in staminate flowers, ca. 4 mm long and 2 mm wide, in pistillate flowers a little smaller; filaments ca. 2 mm long; anthers lanceolate, ca. 1.5 mm long, 0.6 mm wide; fruit straw-yellow, globose, ca. 5 mm in diameter, rather densely covered with small papillae, sparingly hairy; seeds ca. 3 mm long, 4 mm wide, 2 mm thick. Fl. July, Fr. September–October.

Forests, shrubby formations, bamboo thickets (*Sasa kurilensis*). — Far East: Sakh. (S. Sakhalin, Kurile Islands — Sikotan and Urup islands).

Gen. distr.: Jap.-Ch. Described from Japan (?). Type in New York (?).

Note. This E. Asian species is vicarious to the N. American *T. radicans* from which it is not too difficult to distinguish, as Maksimovich pointed out (in herb.) when he collected the species in Japan. It is possible that the specimens from the province of Hupeh in China, known as the Wilson collection, belong to a separate species as yet undescribed.

Economic importance. Although the plant could probably be grown as an ornamental it is not recommended because of its being poisonous. The fruit contains wax.

**T. radicans* (L.) Ktze. Rev. Gen. pl. I (1891) 153; Barkley in Ann. Mo. Bot. Gard. XXIV, 425. — *Rhus radicans* L. Sp. pl. ed. 1 (1753) 266. — *R. Toxicodendron* L. l. c. 266, p. p. — *R. toxicodendron* auct. plur. p. p. — *R. toxicodendron* var. *radicans* auct. plur. — Ic.: C.K. Schn. Laubholz. II, tab. 98, 99; Journ. N. J. Bot. Gard. XV, tab. 137–140; Britt. and Brown, Fl. N. St. and Canada, II, 388; Hegi, Fl. V, 1, tab. 1817; Barkley, l. c. tab. 26.

336 Shrubs or climbers, with glabrous or pubescent (young) branches; leaflets 3 or very rarely 5, irregularly serrate or dentate or entire, rounded to subcuneate at base, acuminate or attenuate-acuminate at apex, glabrous above, glabrous or hairy beneath; terminal leaflet 3–20 cm long, 1.3–13 cm wide, with 1–4.5 cm long petiolule, lateral leaflets usually irregular (asymmetrical), 3–17 cm long, 1.3–10 cm wide, with 1–5 mm long petiolules. Flowers greenish-white, on ca. 2–3 mm long pedicels; sepals triangular-oval, 1 mm long, 0.8 mm wide, glabrous; petals oblanceolate, glabrous, 3 mm long, 1 mm wide; filaments ca. 1.5 mm long; anthers lanceolate, ca. 1 mm long, 0.6 mm wide; fruit whitish or yellowish, globose, 5–6 mm in diameter, usually glabrous; seeds ca. 3 mm long, 4 mm wide, 2 mm thick. Fl. June–July, Fr. September. (Plate XXIX, Figure 2.)

Locally escaped in N. America (from Canada to Mexico, Bermuda and the Bahamas). In the USSR it is very common in botanical gardens in the south where it is grown for unknown reasons, probably because of a love for the exotic. It can cause poisoning. It is of no ornamental value and should be banned from cultivation, including the species listed below, except when toxicological research is involved.

Note. This is a very polymorphic species, varying in habit (shrub and climber), dimensions of fruits and inflorescences, and particularly in shape of leaflets which are typically elliptic or elliptic-acuminate but vary at margin from entire to dentate and even bidentate. All these forms may occur on one plant or the leaflets on one plant may be very similar. American botanists explain this polymorphism by a possible hybridization between the species and subspecies of this section.

Very close to *T. radicans* (L.) Ktze. are the following species, which are also poisonous:

1. *T. quercifolia* (Michx.) Greene — N. America. Leaflets broadly rhombic-oval, with 3–7 orbicular-obtuse incisions reminiscent of oak leaves, hairy beneath; fruit cream-colored, usually hairy; less variable in comparison with the others.

2. *T. diversiloba* (Torr. et Gray) Greene — N. America. Leaflets ovate-elliptic or obovate, entire or serrate-dentate or obtusely lobed, glabrous on both sides, small; terminal leaflet 2–6.5 cm long, 1.5–4 cm wide, with 0.5–1.5 cm long petiolule, lateral leaflets 2.5–6 cm long, 1–5.4 cm wide, sessile or with short petiolules, fruit whitish, usually glabrous.

7 All these species secrete an extremely poisonous milky juice that causes boils, swelling and other infections of the skin. According to some data the toxic ingredients in these species may be of medical value and are sometimes applied in homeopathic practice.

Section 2. *VERNIX* (Adans.) C. K. Schn. Laubholz. I (1907) 151. — Trees or large shrubs, with fairly robust branches; flowers in large drooping lateral axillary panicles; leaves deciduous, alternate, imparipinnate, with many leaflets.

★*T. vernicifluum* (Stokes) Lincz. in Bot. Zhurn. SSSR, XXV, 2 (Majo, 1940) 122. — *Rhus verniciflua* Stokes Bot. Mat. Med. II (1812) 164; Rehd. et Wils. in Sarg. Pl. Wilson. II, 4 (1914) 181. — *R. vernicifera* DC. Prodr. II (1825) 68, excl. specim. nepalensibus; Engl. in DC. Monogr. phan. IV (1883) 398. — *Toxicodendron vernicifera* E.A. et F.A. Barkley in Ann. Mo. Bot. Gard. XXIV (1937) 263. — *T. verniciflua* Barkley in American Midl. Nat. XXIV, 3 (Decembri 1940) 680. — *Rhus vernix* L. Sp. pl. ed. 1 (1753) 265, quoad specim. japonica; Thunb. Fl. Jap. (1784) 121. — Ic.: (sub *Rh. vernicifera*): Bull. Coll. Agric. Tokyo, II, tab. 5, f. 12; Useful Pl. Jap. I, tab. 321; C.K. Schn. Laubholzk. II, tab. 99–100; Wilson. Arn. Arb. Exped. China, 1910–1911, tab. 70; Bull. Soc. Dendr. France (1913) p. 200.

Trees, up to 20 m high; bark of young branches hairy, later glabrous, pale yellow-gray or gray; leaves 25–75 cm long; leaflets 7–15, ovate or oblong-ovate, petioluled, partially veined (8–16 pairs of veins), 7–16(20) cm long, 3–7 cm wide, rounded or broadly cuneate at base, entire, hairy beneath when young, later hairy only along midrib. Flowers yellowish-white, in loose drooping panicles 15–25 cm long; fruit glossy straw-yellow, compressed, broader than long, 0.5–0.8(1) cm in diameter; seeds irregularly globular, compressed, not notched, smooth (without furrows), ca. 4 mm long and wide, 1.5–2 mm thick. Fl. June, Fr. September. (Plate XXIX, Figure 4.)

Locally escaped in SE Asia, from the Himalayas to China and Japan; in the USSR cultivated in botanical gardens in the south for ornamental purposes.

Economic importance. In China and Japan the famous Chinese or Japanese lacquer is obtained by tapping the trunk and branches. The fruit contains an abundance of vegetable wax used for making candles.

It is widespread in gardens and parks because of its large growth and
538 huge crown and also its yellow, drooping clusters of flowers in the fall. A poisonous plant, causing skin injury even on contact with freshly lacquered objects.

2. *T. trichocarpum* (Miq.) Ktze. Rev. Gen. pl. I (1891) 154. — *Rhus trichocarpa* Miq. in Ann. Mus. Lugd.-Bat. II (1865) 84; Engl. in DC. Monogr. phan. IV, 379; C.K. Schn. Laubholzk. II, 152; Rehd. Man. cult. trees (1937) 538. — Ic.: Useful Pl. Jap. I (1895) tab. 322 (sub *Rh. silvestre*); Gard. and Forest, X (1897) 383.

Small trees, (3)6–8 m high; bark on young branches with brownish hairs, later glabrous, pale gray; leaves up to 40–50 cm long; leaflets 13–17, short-petioluled, ovate or oblong-ovate to oval and oblong-oval, (4)6–10 cm long, (3)4–6 cm wide, rounded or rounded-cuneate at base, attenuate-acuminate at apex, usually entire, rarely with few orbicular-triangular teeth in upper part (*β. serrata* Engl.), beneath and rarely above, sparingly pubescent. Flowers greenish-white, in rather puberulent axillary panicles usually branching from the middle upward, up to 20 cm long; pedicels very short, ca. 1.5 mm long; sepals oblong-triangular, obtuse, 1–1.5 mm long, ca. 0.5 mm wide, glabrous; petals obtusely lanceolate, 1.5–2 mm long, ca. 5 mm wide, glabrous; filaments ca. 0.5 mm long; anthers triangular-ovate, ca. 0.5 mm long; fruit small, globose (slightly compressed), brownish-green, ca. 0.5–0.6 cm long, 0.6–0.7 cm wide, densely beset with papillae bearing simple hairs; seeds irregularly reniform, shallowly notched at apex and base, ca. 4 mm in diameter, 1.5–2 mm thick, with shallow longitudinal furrows. Fl. July, Fr. September.

Forests.— Far East: Sakh. (Kurile Islands — Kunashir and Iturup islands). Gen. distr.: Jap.-Ch. Described from Japan (?). Type in Holland.

Note. *T. trichocarpum* is easily distinguished from *T. vernix* (L.) Ktze., *T. succedaneum* (L.) Ktze. and *T. vernicifluum* (Stokes) Lincz. and hence it is not clear why Engler, who had correctly understood this species in 1883 (l. c.), later chose to regard it as only a pubescent-fruited form of *Rhus vernicifera* (Bot. Jahrb. XXIX (1900) 433), i. e., *Toxicodendron vernicifluum*.

Economic importance. An ornamental plant with orange leaves turning purple in the fall; the fruit contains a large quantity of wax.

****T. vernix* (L.) Ktze.** Rev. Gen. pl. I (1891) 153; Barkley in Ann. Mo. Bot. Gard. XXIV, 438.— *Rhus vernix* L. Sp. pl. ed. 1 (1753) 265; Rehd. Man. cult. trees (1927) 539; C. K. Schn. Laubholz. II, 152.— *R. venenata* DC. Prodr. II (1825) 68; Engl. in DC. Monogr. phan. V, 397.— Ic.: Sarg. Silva N. Am. III (1892) tab. 107, 108; Sarg. Man. trees N. Am. (1905) 608; C. K. Schn. l. c. tab. 99, 100; Bailey, Stand. Cycl. Hort. (1916) 2728.

Shrubs or small trees, up to 7 m high; bark of juvenile branches short-hairy, later glabrescent; leaves more than 30 cm long; leaflets 5–11 (13), oblong-elliptic, cuneate at base, shortly attenuate-acuminate or obtuse at apex, entire, 6–7 cm long, 2.4–4.5 cm wide, glabrous above and beneath or slightly pubescent along nerves, dark green above, paler below, with ca. 0.5–0.9 cm long petiolules. Flowers greenish-yellow, in narrow panicles 8–20 cm long; pedicels ca. 0.3–0.5 cm long; sepals obtusely tetragonal-(deltoid) lanceolate, 1.3 mm long, 0.7 mm wide, glabrous; petals oblong-lanceolate, 2.5 mm long, 0.5–1 mm wide, glabrous; filaments ca. 2 mm long; anthers oblong, 1 mm long, 0.6 mm wide; fruit small, globose, slightly compressed, whitish or light yellowish-gray, ca. 0.5–0.6 cm in diameter; seeds ca. 3.5 mm long, 5 mm wide, 3 mm thick, deeply longitudinally furrowed, globular (hardly compressed), shallowly notched at apex and base. Fl. June, Fr. September. (Plate XXIX, Figure 3.)

Locally escaped in the southern part of N. America. Sometimes grown in parks and gardens in the southern regions of the USSR.

Note. The related Asian species *T. succedaneum* (L.) Ktze. (Himalayas, China, Japan) is also often grown as an ornamental, but in its native habitat it is more important for the wax in its fruits.

Economic importance. An ornamental plant with orange and purple leaves in the fall. It is not recommended because of its high degree of toxicity. There are reports (Barkley, l. c.) that it has been applied in homeopathic practice.

Family XCI. **AQUIFOLIACEAE** * DC.

Flowers in 1 to many axillary umbelliform corymbs, racemes or panicles, regular, 4–5-merous (rarely polymeric), plants dioecious; sepals half-connate; corolla of 4–5 petals free or connate at base; stamens as many

* Treatment by A. I. Poyarkova.

as petals, free or basally adnate to petals; ovary superior, 4–6-locular (rarely multilocular), without style or with very short one; stigma lobate or capitate; cells with 1(2) anatropous pendulous ovules; staminate flowers with rudimentary ovary, pistillate flowers with sterile anther-bearing stamens; fruit drupaceous, with 3–6 1-seeded pyrenes; seeds with fleshy oily endosperm and small terminal embryo. Shrubs or low trees, usually evergreen, rarely deciduous, with entire alternate leaves 540 and small caducous stipules.

There are more than 300 species of 3 genera in this family distributed mainly in the tropical and subtropical countries, mostly in Central and South America.

Genus 865. **ILEX** * L.
L. Sp. pl. (1753) 125

Flowers usually 4-merous, rarely 5–9-merous; calyx developed, with conspicuous lobes persistent under fruit; corolla rotate; petals usually shortly connate at base, rarely completely free, ovate or elliptic to orbicular, obtuse at apex, imbricate in bud; filaments adnate to corolla at base; staminodes in pistillate flowers similar to stamens but shorter than petals and with smaller sterile anthers, pistillodes in staminate flowers conical, without stigmas; fruit globose or somewhat elongated, drupaceous, red or black, rarely yellow, fleshy, with (1)2–4(9) pyrenes. Small trees or shrubs, usually evergreen, rarely deciduous.

More than 270 species in the Old and New Worlds, mainly in tropical South America and tropical and subtropical Asia.

The genus *Ilex* was distributed in the USSR from Upper Cretaceous to Pliocene.

Ilex ambigua Ung. in Middle Eocene E. Transc. (Shor-Bulak–Dzhirvezh). – *I. aquifolium* L. in Pliocene (Apsheron) E. Transc. (Shirak Steppe) and Chauda (Upper Pliocene) Guria. – *I. falsanii* Sap. et Mar. in Oligocene W. Transc. (Goderzi). – *I. insignis* Heer. (?) in Upper Oligocene Sakh. (Cape Rogatyi). – *I. longifolia* Heer. in Upper Cretaceous Ob (Loz'va). – *I. pacifica* Baik. in Upper Oligocene Sakh. (Cape Sernyi). – *I. schmidtiana* Heer. in Upper Cretaceous Ob (Simonova), Oligocene Uss. (Pos'et). – *I. stenophylla* Heer. in Upper Cretaceous Ob (Simonova), Paleocene L. V. (Ushi). – *Ilex* sp. in Paleocene M. Dnp. (Adzharka), Oligocene Irt. (Ashutas) and Uss. (Rechnoi Peninsula) and W. Transc. (Goderzi).

1. Leaves with large spiny teeth (sometimes entire in older specimens), large, on an average not less than 4 cm long, 1.5 cm wide; fruit red . . . 2.
- + Leaves with small unarmed teeth, sometimes entire, small, on an average not more than 2.5 cm × 1 cm . . . 5.
2. Pyrenes broad, with protruding longitudinal ribs and faintly defined lateral faces . . . 3.
- + Pyrenes narrow, with very thin, hardly protruding ribs and well-defined lateral faces . . . 4.

* From the Hebrew *elon* – oak and the Celtic ending *es*.

3. Nerves at upper side of leaves indistinct, beneath with 7–10 pairs of rather sharply protruding, lateral nerves; pyrenes 6–8 mm long, 4–6 mm wide, with coarse ribs **I. aquifolium* L.
- + Upper side of leaves distinctly netted-veined, 6–7 pairs of lateral nerves protruding beneath but usually not sharply; usually 6–7 pairs; pyrenes small, 5–7 mm long, 3.5–4.5 mm wide, with thinner ribs 1. *I. colchica* Pojark.
4. Leaves 1.8–6 cm long, 0.9–3 cm wide, with 2–4 teeth at each margin, sharply netted-veined 3. *I. hyrcana* Pojark.
- + Leaves larger, 4.5–9 cm long, 2–4.5 cm wide, with 3–7, usually 5–6 teeth at each margin, nerves at upper side of leaves not as distinct, often almost inconspicuous 2. *I. stenocarpa* Pojark.
5. Fruit black, with faintly ribbed or nearly smooth pyrenes; leaves smooth, without protruding nerves, not dark dotted beneath, usually ovate-elliptic, crenate-dentate and entire 4. *I. crenata* Thunbg.
- + Fruit red, with ribbed-furrowed pyrenes; leaves sharply netted-veined at upper side, dark-dotted beneath, usually lanceolate-elliptic, with appressed teeth above 5. *I. rugosa* Fr. Schmidt.

**I. aquifolium* L. Sp. pl. (1753) 125; DC. Prodr. II, 13; Schneid. Laubholz. II, 163. p. p.; Hegi, Ill. Fl. V, 1, 236. — *I. aquifolium* var. *occidentalis* Loes. in Nova Acta Acad. Leop.-Carol. LXXVIII (1901) 257. — Ic.: Rchb. Ic. Fl. Germ. tab. 1080; Hegi, l. c. f. 1824, 1825, 1828. — Exs.: Fl. Gall. et Germ. exs. No. 2820 et bis.

Shrubs or trees, up to 10 m high, with 10 m high, with glabrous greenish-brown shoots; leaves coriaceous, dark green and shiny above, paler and dull beneath, 3–10 cm long, 2.5–5 cm wide, undulate and spiny-incised-dentate at margin, usually with 5–9 teeth, but leaves of old shoots often entire or with few, 1–3, irregular teeth, lateral nerves 7–10 pairs, inconspicuous at upper side of leaves but rather sharply protruding beneath, net of nerves not visible at all. Staminate flowers usually in 3-flowered umbelliform corymbs, on peduncles 3–10 mm long, pistillate flowers solitary, rarely 2–3 on shorter peduncles; pedicels glabrous, short-hairy like calyx; calyx, petals and stamens 4(5); petals white; fruit globose or ovoid, 7–10 mm long, 6–10 mm wide, with 4(5) pyrenes; pyrenes broad, 6–8 mm long, 4–6 mm wide, with faintly defined faces and coarse longitudinal ribs, pitted between the ribs. Fl. May, Fr. from July. (Plate XXVII, Figure 3.)

- 542 In the USSR cultivated in parks and gardens only in the S. European part. Grows naturally in Scandinavia — in Norway up to 63° N, Atl. Eur., except for N. Scotland, Med., Bal.-As. Min. only in the Balkans. Mainly growing in beech forests, rarely in mixed broadleaved or spruce. Described from S. Europe. Type in London.

Economic importance. *I. aquifolium* has been cultivated in W. Europe as an ornamental plant for many years. The shrubby forms are planted as hedges, remaining as such for decades. The woody forms are planted on boulevards and also as groves. Numerous cultivars are known, differing in spinescence of the leaves and their shape, ranging from completely unarmed leaves (f. *integrifolia* Nolte, f. *laurifolia* Loud.) to leaves beset with spines not only at the ends of the teeth but also on the upper

surface (f. *ferox* Ait. = *I. echinata* Mill.). Cultivated in the USSR, sometimes in the Crimea and S. European part of the Soviet Union. The wood is used for various woodcraft purposes and the bark and fruits have been used in popular medicine in Europe for the same purposes as the Caucasian holly has been used by the local populations of the Caucasus.

1. *I. colchica* Pojark. in Referaty rabot Biol. Otd. AN SSSR za 1945 g. (1947) 9. — *I. aquifolium* M.B. Fl. taur.-cauc. I (1808) 116, non L.; Ldb. Fl. Ross. III, 1, 35, p. p.; Boiss. Fl. Or. IV, 34, p. p.; Medved., Der. i kust. Kavk. 202, p. p.; Grossg., Fl. Kavk. III, 43, p. p. — *I. aquifolium* var. *caspia* Loes. in Nov. Acta Acad. Leop.-Carol. LXXVIII, 1 (1901) 262, p. p. — *I. aquifolium* var. *caspia* f. *angustifolia* Loes. l. c. 263, p. p. — Exs.: Fl. cauc. exs. No. 119.

Mostly shrubs, up to 2.5 m high; stems usually decumbent, rooting in places thus forming new plants; shoots glabrous, covered with brown bark; leaves evergreen, coriaceous, stiff, elliptic, often narrow-elliptic or lanceolate, rarely broadly elliptic, (4)5–10 cm long, (1.7)2–4 cm wide, cuneate at base, shiny above, dull beneath, spiny-incised-dentate, with 3–7, usually 5–6 teeth at each side, lateral nerves 6–7 pairs, impressed at upper face (like nerves of third order), protruding beneath, often rather faintly. Inflorescences umbelliform corymbs, few in axils of leaves; staminate racemes usually of 3 flowers ca. 1 cm long, pistillate racemes usually 1-flowered; calyx half-connate, with 4 broadly triangular acute lobes; corolla whitish, rotate; petals in staminate flowers oblong-obovate, in the pistillate broader, ovate; filaments as long as anthers and exceeding petals; ovary globose, with capitate stigma; fruiting stalks 3–5 mm long; fruit red, fleshy, drupaceous, 8–10 mm long, 7–10 mm in diameter, with 4 pyrenes; 543 pyrenes trihedral, bilaterally compressed, dorsally often depressed, 5–7 mm long, 3.5–4.5 mm wide, with longitudinal wide ribs. Fl. April–May, Fr. from July. (Plate XXVII, Figure 5.)

Undergrowth in beech and mixed broadleaved forests of the Colchis. — Caucasus: W. Transc. Gen. distr.: Bal.-As. Min., As. Min. and Lazistan. Described from Petskir gorge near Sukhumi. Type in Leningrad.

Economic importance. Should be cultivated as an ornamental in the southern regions. The wood is greenish-white, very hard, of a fine and even texture, well-polished, heavy and difficult to split. It is useful in the manufacture of different tools and gun handles. The leaves which contain dyeing and tanning agents and bitter glucoside — ilicin — are used by the local populations in treatment of fever and stomach ailments. The bark and roots contain emollient properties used to treat coughs. The fruit is poisonous and causes vomiting and diarrhea. In former times it was applied in cases of epilepsy. A favorite of birds.

Note. The specimens from Adzhar are peculiar among the Colchis plants with their distinct characters, because of their narrower pyrenes and thinner texture, and the leaves having less coarse and pressed teeth often bearing a spiny mucro. Leaves of this kind were also found in one sterile specimen from the former Artvin District. A serration of this kind is very rare in *I. colchica* in which coarse, incised teeth are common. According to V. B. Sochava, who studied in nature the features of the Adzhar plants, the serration is a constant character. In addition, they do not grow

in the form of a shrub but like a real low tree ca. 3 m high. More material and field observations are required in order to analyze the taxonomic position of the W. Transcaucasian holly.

2. *I. stenocarpa* Pojark. in Referaty rabot Biol. Otd. AN SSSR za 1945 g. (1947) 9. — *I. aquifolium* auct. fl. cauc. p. p. non L.

Low shrubs, ca. 0.5 m high; shoots glabrous; leaves evergreen, rigid; elliptic, rarely lanceolate or subovate, 4.5–9 cm long, 2–4.5 cm wide, dentate-incised, with 3–5 teeth on each side, lateral nerves (5)6–7 pairs, hardly visible in upper side, protruding beneath but not sharply or even slightly, minutely and indistinctly netted-veined. Inflorescence and flowers as in *I. colchica*; fruit red, globose or ellipsoid, 9–11 mm long, 7–8 mm wide; pyrenes similar to those of *I. hyrcana* in structure, narrow, 5–7 mm long, 2.5–3 mm wide, lateral and dorsal faces defined, with thin longitudinal ribs. Fl. April–May, Fr. from August.

Underwood in beech and mixed forests. — Caucasus: Cisc. only in the western part. Endemic. Described from the basin of the Laba River, a tributary of the Kuban. Type in Leningrad.

3. *I. hyrcana* Pojark. in Referaty rabot Biol. Otd. AN SSSR za 1945 g. (1947) 9. — *I. aquifolium* Ldb. Fl. Ross. II, 1 (1847–1849) 35, p. p. non L.; Boiss. Fl. or. IV, 34, p. p.; Medved., Der. i kust. Kavk. 212, p. p.; Grossg., Fl. Kavk. III, 43, p. p. — *I. aquifolium* var. *angustifolia* Hohenack. in Bull. Soc. Nat. Mosc. XI, 3 (1888) 319. — *I. aquifolium* var. *caspia* Loes. in Nov. Acta Acad. Leop.-Carol. LXXVIII, 1 (1901) 262, p. p. — *I. aquifolium* var. *caspia* f. *angustifolia* Loes. l. c. p. p. — *I. aquifolium* var. *caspia* f. *spinigera* Loes. l. c. p. p.

Shrubs or small trees, with thin grayish-brown shoots, shortly and usually rather densely pubescent; leaves evergreen, rigid, elliptic or obovate, rarely narrowly elliptic, small, 1.8–6 cm long, 0.9–3 cm wide, shiny above, dull beneath, spiny-incised-dentate into 2–4 teeth at each side, with 4–6 secondary lateral nerves, protruding above, less so beneath, distinctly and finely netted-veined at both sides. Inflorescence and flowers as in preceding species; fruit red, 8–10 mm long, 6–8 mm in diameter, on stalk 2.5–8 mm long; pyrenes 4, narrow, 6.5–7 mm long, 3–3.5 mm wide, with distinctly defined lateral faces and thin but rather sharply prominent longitudinal ribs. Fl. April, Fr. August. (Plate XXVII, Figure 4.)

Undergrowth in forests mainly of the middle belt, rarely of the lower or upper. — Caucasus: Tal. Gen. distr.: Iran. (in relict forests of the Caspian part of Iran). Described from Talysh Mountains. Type in Leningrad.

4. *I. crenata* Thunb. Flor. Jap. (1784) 78; Willd. sp. pl. I, 1, 710; DC. Prodr. II, 16; Fr. Schmidt. Reise im Amurl. u. Sachal. (1868) 122; Maxim. in Mem. Acad. St.-Petersb. VII, ser. XXIX, 3, 21; Miyabe in Mem. Boston. Soc. Nat. His. IV, 7, 223; Komar. and Alis., Opre del. rast. Dal'nevost. kr. II, 717. — *I. crenata* var. *genuina* Loes. in Nova Acta Acad. Carol.-Leop. LXXVII (1901) 201. — *I. fortunei* hort. non Lindl. — Ic.: Fl. Az. Ross. V (1914), f. 3.

Shrubs up to 2 m high, with gray bark, numerous short and densely leafy thin branches and narrowly ribbed gray shoots often very short-hairy when young; leaves evergreen, with 2.5–6 mm long petioles, coriaceous, 1–4.5 cm long, 0.4–2 cm wide, elliptic to lanceolate-elliptic, oblong-oval or obovate, cuneate or rounded-cuneate at base, obtuse or acutish at apex, above dark green, shiny and glabrous, beneath paler, dull, sometimes short-hairy along midrib, serrulate at margin, inconspicuously nerved. Inflorescences usually solitary in axils of leaves, the staminate usually 3-flowered, the pistillate 1-flowered; pedicels of staminate flowers up to 3.5 mm long, of the pistillate 4–9 mm long; flowers 4-(5-)merous; calyx saucer-shaped, half-connate, with broadly triangular obtuse or acutish lobes; corolla rotate, with oval petals connate up to $\frac{1}{4}$ – $\frac{1}{3}$; stamens and staminodes half as long as corolla; ovary ovate, with 4-lobed discoid stigma; pistillodes flattened-conical; fruit black, globose, 6–8 mm in diameter, mealy-fleshy, with 4 pyrenes; pyrenes broad, 4.5–5.5 mm long, 3–4 mm wide, slightly striate-ribbed to nearly smooth. Fl. July, Fr. September.

Slopes at forest edges. — Far East: Sakhal. (the entire island and the Kuriles). **Gen. distr.:** Jap.-Ch., Jap. Described from Japan. Type in Uppsala.

Note. *I. crenata* Thunb. is absent in Sugawara (III. Fl. of Saghal. III (1940) 1267) and *I. radicans* Nakai (Rep. veg. mont. Apoi (1930) 37) is described with *I. crenata* subsp. *radicans* (Nakai) Tabew et Mimoto (Fl. Kaibato, II, p. 243) in its synonymy. Due to lack of data and material we are not convinced of the accuracy of this presentation of the Sakhalin holly, which has been obscured by treating *I. crenata* Thunb. as a synonym of *I. radicans*.

5. *I. rugosa* Fr. Schmidt, Reisen in Amurl. u. Sachal. (1868) 122; Maxim. in Mem. Acad. St.-Petersb. VII, ser. XXIX, 3, 29 et 47; Miyabe in Mem. Boston Soc. Nat. Hist. IV, 223; Loes. in Nova Acta Acad. Carol.-Leop. LXXVIII (1901) 420; Komar. and Alis., Opredele. rast. Dal'nevost. kr. II, 717; Sugawara, II. Fl. of Saghal. III (1940) 1269. — Ic.: Fr. Schmidt, l. c. tab. III, f. 1–7; Komar. and Alis. l. c. tab. 215; Fl. As. Ross. V, f. 4; Sugawara, L. C. tab. 583.

Low, evergreen, creeping shrubs, with thin green shoots and branches, longitudinally 5-ribbed; leaves broadly or narrowly lanceolate, coriaceous, glabrous, shiny and olive-green above, paler and less shiny beneath, dark brown in the herbarium, 1.5–5.5 cm long, 0.4–1.8 cm wide, distinctly nerved above, beneath with conspicuously protruding midrib and strongly rugose beneath, remotely denticulate at margin, with teeth appressed above; petioles 2.5–5 mm long. Inflorescences in axils of leaves, the staminate corymbs shortly (2–3 mm) stalked, usually (1)2–3-flowered, the pistillate 1–2 flowered, usually 1-flowered; pedicels 3–6 mm long, with small bract at base; flowers 4-(5-) merous; calyx half-connate, with orbicular lobes; corolla rotate, with oval or elliptic petals connate at base in staminate flowers, free in pistillate; stamens slightly longer than petals, staminodes $\frac{2}{3}$ to $\frac{3}{4}$ as long as petals; ovary ovate, with discoid thick stigma; pistillodes conical; fruit globose, 5–6 mm in diameter, red-brown (according to Schmidt), bright red (according to other collectors), fleshy, with 4(5) pyrenes; pyrenes 3–4 mm long, 1.5–2 mm wide, ribbed-furrowed. Fl. July, Fr. September–October.

Cedar-spruce and fir-spruce forests.— Far East: Uss. (Khor River), Sakh. (mountains in the central and southern part of the island), Kurile Islands. Gen. distr.: Jap.-Ch., Jap. (Hokkaido and Hondo Island). Described from Sakhalin. Type in Leningrad.

Economic importance. An ornamental plant. The fruits are used by local populations against toothache.

Note. The report of *L. rotunda* Thunb. from the Maritime Territory of the USSR (Komar., Fl. Man'chzh. III, 817; Krishtof in Fl. Az. Ross. V, 13), based on a herbarium specimen collected in 1859 by Wilford between 44° and 45°N, should be regarded as absolutely incorrect. Later findings within Soviet limits have never been confirmed, which is only natural since this evergreen tree is common only to the subtropical SE Asia (Hainan Island, Taiwan, SE China, the southern islands of Japan) and does not extend further northward than Quelpart and Tsushima islands and the southern part of Honshu.

Family XCII. **CELASTRACEAE** * LINDL.

Flowers small, regular, bisexual or unisexual, usually in cymose or corymbiform, rarely racemiform inflorescences, sometimes solitary; calyx small, 4–5-parted, persistent, with imbricate lobes; petals 4–5, free, imbricate; disk usually well developed, hypogynous, horizontal, fleshy; stamens alternating with petals, as many as petals, on surface or at margin of disk, with subulate usually short filaments and 2-locular short but broad anthers, sometimes 1-locular as the result of fusion of cells, usually opening inside by 2 longitudinal slits; ovary superior, freely sessile on disk or more or less sunk in the latter, 1 to 5-locular, abruptly elongating above into short thickened simple or more or less 3–5-partite style, with entire or lobate stigma; ovules usually 2 at inner angle of each cell, erect, rarely pendulous, anatropous, with ventral denticle; fruits variable, dry (always in the USSR) or juicy (outside the USSR); seeds erect, only rarely pendulous, with copious fleshy endosperm and large straight embryo with flat green foliate cotyledons usually wholly or only partly covered with bright fleshy aril (or caruncle). Trees or shrubs, often spiny (not in the USSR), and climbing; leaves alternate or opposite, always simple, entire, eglandulose, often coriaceous, with small deciduous or persistent stipules.

Subfamily 1. **CELASTROIDEAE** Lois. in E. and P. Pflanzenfam. III, 5 (1892) 199. — Fruit a loculicidally dehiscent capsule.

Key to Genera

1. Carpels equal in number to stamens, sepals or petals. Tribe 1.
EUONYMEAE

Stigma small, entire or hardly lobed; capsule usually parted, dehiscent by 4–5 valves, without relics of style above, rarely consisting of only 1 or 2 developed lobes; flowers flat, bisexual, in

* Treatment by Ya. I. Prokhanov.

- cymose inflorescences; shrubs, leaves opposite or sometimes whorled, partly alternate, with deciduous stipules 2.
- + Carpels less in number than stamens, sepals or petals. Tribe 2.
EUCELASTREAE.
- Stigma discoid, trifid; capsule always globose, dehiscing by 3 valves, with relics of style above; flowers cup-shaped—campanulate, unisexual in dioecious plants, usually in racemiform or paniculate inflorescences or solitary; creeping or climbing shrubs; leaves always alternate, stipules persistent 868. *Celastrus* L.
2. Flowers mostly 4-merous; filaments distinct but usually short; anthers distinctly 2-locular; capsule not winged; ovules and seeds erect; buds, even in the fall, comparatively small 866. *Euonymus* L.
- + Flowers usually 5-merous, rarely 4-merous; filaments abortive, tubercle-like; anthers 1-locular on opening; capsule often more or less winged, with wings at least half the width of the cell; ovules and seeds pendulous; buds long-fusiform elongating in the fall 867. *Kalonymus* (J. Beck). Prokh.

Tribe 1. EUONYMEAE Lois. in E. u. P. Pflanzenfam. III, 5 (1892) 199. — For characters see Key above.

548 Genus 866. **EUONYMUS** * L.
L. Gen. pl. ed. 5 (1754) 91.

Flowers flat, bisexual, 4-merous (rarely 5-merous), in simple or compound cymes, rarely solitary, on long peduncles in axils of scales or developed leaves, with basal bracts on cyme and bracteoles on pedicels; sepals spreading or recurved; petals horizontal, orbicular to linear, greenish-white or purple, sometimes spotted, entire or fimbriate; disk large, broad, slightly 4-(5-) lobed; stamens at upper margin of disk; filaments short but distinct, sometimes undeveloped and more or less reduced; anthers flattened-reniform, distinct from filaments, each cell opening by 2 slits in different directions united above; ovary gradually intergrading to disk or sunk in it, 4-(rarely 5-) locular, sometimes with one abortive cell; style usually short with entire or slightly 4-(5-) lobed stigma; capsules usually developed from only some of the flowers, coriaceous, 4-(rarely 5-) locular, sometimes only 3-, 2-, or even 1-locular, globose or pyriform, often disciform, usually 4-(rarely 5-) parted, with more or less angular lobes, sometimes (not in the USSR) beset with spines, without relics of style; seeds erect, 1 or 2 in each cell at inner margin of septum, coat coriaceous, entirely or only half covered with bright fleshy aril. Erect or sometimes procumbent shrubs or trees, unarmed, glabrous,

* From the Greek euonymos - "well-named" (from eu - well, onoma - name); first used by Theophrastus for *Euonymus*, obviously in sarcasm since the tree exudes a disagreeable odor.

with acutely tetragonal or rarely rounded branches, often with verrucose, stalked or longitudinally pteroid, suberose outgrowths; leaves opposite, sometimes partly alternate together with whorled ones, coriaceous or scarious, evergreen or deciduous, serrate or entire, usually short-petioled, with deciduous filiform stipules.

Chemical features. All parts of *Euonymus* are more or less poisonous. The seeds contain glucoside euonymin, emulsion and fatty oil. The distilled leaves yield wood alcohol. The fruits and especially the root contain a mixture of citric, malic and tartaric acids. In the roots in special cells (idioblasts) of the primary cortex gutta-percha (a kind of rubber) is accumulated.

Economic importance. In the USSR *Euonymus* is a valuable technical 549 plant being the basic source of gutta-percha widely used in plastics and as an insulator. Gutta-percha was first discovered in *Euonymus* in the USSR in 1932 by Bosse. It was found in special cells (idioblasts) in the primary cortex of the roots of *E. verrucosa*. Up to that time gutta-percha had been imported.

In different species of *Euonymus* (and also in species of *Kalonymus*, of which see below) the content of gutta-percha in the roots varies. According to the latest data (Pravdin, 1947) the highest average yields (7%) have been achieved from the locally escaped *E. verrucosa* and the cultivated *E. japonica*. The species of *Euonymus* according to their yield of gutta-percha are as follows: *E. maackii* (6%), *E. europaea* (4%), *E. sacrosancta* (2%), *E. pauciflora* (1%), and *E. nana* (less than 1%).

Unfortunately, the attempts to find any correlation between the taxonomic position of the species and their yield of gutta-percha have not been successful. The high yielding species in the USSR, *E. verrucosa* (7%), vicariates the Far Eastern *E. pauciflora*, which produces only 1%; conversely, in the West the moderate *E. europaea* (4%) vicariates the rich Eastern *E. maacklii* (6%).

However, correlation between the gutta-percha yield of different species or of populations of one species and their ecology has been established. In all cases an increase yield was observed in open and more arid habitats compared with shady, damp localities. Hence we can understand the increased yield of the photophilous *E. maacklii*, growing along the rivers of the Far East, in comparison with the closely related European *E. europaea* growing in forests, or the poor yield of the Far Eastern *E. pauciflora*, growing strictly in forests, in comparison with the more dry-resistant European *E. verrucosa*. The yield of gutta-percha in the latter species is being markedly increased from the more humid west to the more arid east of its distribution area.

Among the locally escaped plants of interest as gutta-percha producing are *E. verrucosa*, *E. maacklii* and *E. europaea*, and among the cultivated ones *E. japonica*.

Not without interest is *Kalonymus latifolia* (see *Kalonymus* below).

Some species of *Euonymus* (especially *E. verrucosa*) have been grown under cultivation in the USSR in view of their natural depletion. One of the major obstacles in the cultivation of these plants is the unusually long time for the seeds to germinate (18–20 months). A method must be found to shorten this period.

Selection should also be focused on a higher content of gutta-percha in the roots, now sometimes reaching 15%.

In addition to gutta-percha, *Euonymus* is also valued for its light and hard wood widely used in woodwork. The yellowish timber of the European species is very popular. Branches carbonized in closed iron tubes are of value in the manufacture of tinted pencils, known in France under the name of the genus.

The bitter fruits of the European *Euonymus* cause vomiting and act as an emetic. When ground up they are a popular means of treating rashes and parasites. The bark extract of some species is used as an emetic and also a tonic, particularly in America. The orange substance of the aril is used to dye moroccan leather and in the Eastern countries is used in the cosmetic industry.

Euonymus is also cultivated as an ornamental plant because of the color of the fruits and seeds against a background of leaves.

There is very little data about *Euonymus* in the USSR from Tertiary deposits, possibly because of its leaves being unknown in their fossilized state. The few findings are so far: *Euonymus latifolia* Scop. in Quaternary post-glacial tuff of E. Transc. (Makart).— *E. ovalifolia* Bors. in Eocene Sakh. (Brodyazhenskaya).— *E. proserpinae* Ett. in Sarmatian Bl. (Amrosievka).

1. Stamens with conspicuous filaments; corolla greenish-white; styles elongated; capsule globose or more or less 4-lobed, sometimes deeply parted, so lobes partly abortive; seeds entirely enveloped by aril; branches smooth, although often winged; leaves opposite 2.
- + Stamens with obsolete filaments and subsessile anthers; corolla more or less purple; capsule more or less 4-lobed, never globose and not parted; seeds only partly enveloped by aril; branches usually more or less verrucose; leaves generally opposite but sometimes whorled and alternate (section *Kalonymopsis*) 7.
2. Capsule globose, not lobed (section *Illicifolius*); inflorescence luxuriant, 4–5 times furcately branching; leaves evergreen, obovate, rounded at apex, obtusely large-crenate **E. japonica* L. f.
- + Capsule pyriform, 4-lobed or deeply parted, with only 1 or 2 developed lobes; inflorescence simple or a 2–3 times furcately branching cyme; leaves deciduous (sometimes slightly coriaceous), of another shape, more or less cuspidate, more denticulate 3.
3. Capsule deeply parted, with only 1 or 2 developed and nearly free lobes; stamens with conspicuous filaments (section *Melanocarya*); leaves serrulate-dentate, with mucronate teeth, ciliate beneath along nerves 5. *E. sacrosancta* Koidz.
- 551 + Capsule pyriform, commonly 4-lobed, lobes as many as ovary cells (section *Pragmotessara*); leaves sparingly pubescent or glabrous, with obtuse or acute but not mucronate teeth 4.
4. Inflorescence a simple cyme of 2–4 rays, usually half as long as leaf; annotinous branches velutinous-tomentose; capsule deeply lobed, short-hairy (series *Velutinae*) 4. *E. velutina* (C. A. M.) Fisch. et Mey.
- + Inflorescence a simple or compound cyme, usually distinctly longer than leaf; annotinous branches and capsule glabrous (series *Europaeae*) 5.

5. Stamens with yellow anthers, filaments $1\frac{1}{2}$ —2 mm long; leaves cuneate at base, oblong-elliptic or obovate-oblong, usually wider above middle, with short mucro at the more or less obtuse apex, usually distinctly hairy beneath; capsule rather deeply lobed 1. *E. europaea* L.
- + Stamens with violet anthers; leaves usually rounded at base; capsule not deeply lobed 6.
6. Leaves ovate-rhombic or lanceolate (not wider than 5 cm), twice as long as wide, long-acuminate with simple teeth, glabrous; stamens with filaments $2\frac{1}{2}$ —3 mm long; capsule slightly lobed 2. *E. maackii* Rupr.
- + Leaves elliptic or orbicular-oblong (wider than 4 cm), usually ca. $1\frac{1}{2}$ times longer than wide, obtuse or only short-cuspidate, bidentate with crenate teeth, more or less pubescent beneath along nerves; stamens either with short filaments and long style or with long filaments and short style (heterostyly); capsule not lobed 3. *E. sieboldiana* Blume.
7. Seeds enveloped for the most part by aril with a lateral gap; cymes with long persistent bracts, fasciculate only at axils of basal scales of shoot; branches orbicular-tetrahedral, smooth (series *Semenovianae*); leaves ovate-lanceolate or narrowly lanceolate, flat, crenate-serrate, opposite 6. *E. semenovii* Rgl. et Herd.
- + Seeds slightly enveloped by aril with its ends protruding outwardly and a gap above; some or all cymes in axils of common leaves; branches usually verrucose; leaves opposite or alternate 8.
8. Leaves opposite, less than 4 times longer than wide, scarious, pubescent or rarely glabrous, with even margin; rather tall and erect shrubs, with densely verrucose branches (series *Verrucosae*) 9.
- + Leaves whorled and alternate, more than 4 times longer than wide, coriaceous, glabrous, with incurved margin; seeds small, protruding from the open capsule; low semishrubs, with procumbent slightly verrucose shoots (series *Nanae*) 10.
9. Cymes usually exceeding leaves, 3—9-flowered, furcate for once or twice, with early deciduous bracts; leaves rounded at base, widest below middle, acute or obtuse, sometimes mucronulate, crenate-serrate, with gnawed teeth, glabrous, only sometimes short-ciliate beneath along nerves; capsule more or less rounded at base, obtusely lobed, yellowish; seeds with loose aril soon turning brown 7. *E. verrucosa* Scop.
- + Cymes shorter than leaves, 1—3-flowered, usually 3-flowered with lateral pedicels much longer than the median, sometimes pedicels absent, bracts long persistent; leaves tapering, sometimes rounded at base, widest above middle, long-acuminate, finely and acutely serrulate, with entire ciliate teeth, sparingly short-hairy above, more or less densely hairy beneath, especially along nerves; capsule pink, conically tapering towards base, deeply lobed with narrow acutely keeled lobes; seeds firmly enveloped, by constantly orange aril 8. *E. pauciflora* Maxim.
10. Leaves more or less tapering at base, linear-spatulate or linear-oblong, not longer than 3.5 cm, usually widest above middle, rounded or truncate 9. *E. nana* M.B.

- + Leaves obviously cordate at base, narrowly lanceolate or linear-lanceolate, sometimes up to 7.2 cm long, usually widest below middle, obtuse 10. *E. koopmanni* Lauche.

Section 1. *ILICIFOLIUS* Nakai in Journ. Jap. Bot. XVII-11 (1941) 617; Acta Phyt. et Geob. XIII, 28.— For characteristics see page 420 of the key. Type of section: *Euonymus japonica* L. f.

**E. japonica* L. f. Suppl. pl. (1781) 154; Thunb. Fl. Jap. 100.— Ic.: Hook. f. and Arnott, Bot. Beechey's Voy. tab. 54; Hegi, Ill. Fl. V, 1, 247.— Exs.: C. Boenitz, herb. dendr.

553 Trees, 4.5–5 m tall, with erect stems; branches suborbicular, only slightly tetrahedral, faintly striped, dark brown; buds fusiform, up to 10 mm long in the fall, brown-scaled; leaves evergreen, cuneate at base, obovate or rarely narrowly elliptic or broadly ovate, 2–7(9) cm long, 1–4(5) cm wide, rounded at apex, coriaceous, shiny above, incurved at margin, large-crenate, with distinct midrib and inconspicuous lateral ribs, with 5–15 mm long petioles. Cymes luxuriant, usually 3 to 5 times divaricately furcate, on long erect peduncles, 2–6 cm long, shorter than leaf; flowers 4-merous, 4–8 mm in diameter; petals orbicular, greenish-white, paler at margin; stamens with 1–3 mm long filaments; styles nearly as long as stamens; ovary flattened; capsules flattened-globose, 6–8 mm long, 8–10 mm wide, pink, smooth, obscurely furrowed, slightly 4-ribbed, with ribs on and between valves; seeds ovate, 5–8 mm long, entirely enveloped by orange aril.

Cultivated in the Crimea and the Caucasus, also in Central Asia (Tashkent). Habitat: Japan. Described from Japan. Type in London.

Economic importance. In a prospective average gutta-percha yield of 7% this species does not fall behind *E. verrucosa* and therefore it should be grown for this purpose in the more southern regions.

In warmer localities it is cultivated in gardens and parks as an ornamental (for its fruit). Numerous varieties occur in cultivation, differing in shape and color of the leaves. It is worth noting that the many forms of variegated leaves with partly or wholly undeveloped green color are not as outstanding as those with a golden and silver hue.

Section 2. *PRAGMOTESSARA* (Pierre) Nakai in Journ. Jap. Bot. XVII-11 (1941) 616; Acta Phyt. et Geob. XIII, 30.— *Pragmotessara* Pierre, Fl. Forrest. Cochinch. IV (1894) t. 309 B. D.— For characteristics see page 421 of the key. Type of section: *Euonymus europaea* L.

1. *E. europaea* L. Sp. pl. (1753) 197, p. p.; Ldb. Fl. Ross. I, 497; Boiss. Fl. or. II, 8; E. Bush in Mat. Fl. Kavk. ed. 35, 37.— *E. vulgaris* Mill. Dict. ed. 8 (1768) No. 1.— *E. fibrillifera* Fisch. et Mey. in Bull. Soc. Nat. Mosc. XI (1838) 338.— *E. floribundus* Stev. in Bull. Soc. Nat. Mosc. XXIX, 2 (1856) 122 in textu.— *E. media* Kit. in Linnaea, XXXII (1868) 641.— Ic.: Schlecht. Lang. u. Schenk, Fl. Deutschl. 5 Aufl. XXI, tab. 2179; Vol'f and Palibin, Opr. der. i kust. 560.— Exs.: G. R. F. No. 1061; Fl. austro-hung. No. 2854.

Shrubs, rarely trees, 2–5 m high; branches obtusely tetrahedral, green with brownish corklike ribs, later grayish-brown; buds small, ovoid-conical; leaves petiolate (petioles 2–16 mm long), mostly cuneate at base, oblong-elliptic or obovate or rarely broadly ovate (*E. media* Kit.), 1.5–7(11.5) cm long, 1–4(6.5) cm wide, widest above middle, 554 rounded at apex except for lower leaves, with short mucro ($\frac{1}{10}$ as long as blade), regularly serrate with hamate teeth, somewhat coriaceous, glabrous above, dull, short-hairy, beneath along nerves. Cymes usually with abortive median flower, furcate for once or twice, 2–5-flowered, shorter or rarely longer than the reduced subtending leaves, the lower pair of inflorescence directly at axils of scales; bracts subulate, close to bracteoles, squamiform, often persistent; flowers 4-merous, 10–12 mm in diameter, $\frac{1}{3}$ to $\frac{1}{2}$ as long as pedicels; calyx with broadly ovate obtuse lobes, half as long as petals; petals spatulate-oblong, yellowish-green, obtuse, ciliate, dentate at the incurved margin; stamens with 1.5–2 mm long filaments and yellowish anthers; ovary obtusely conical, glabrous; styles subcylindrical, shorter than stamens, with obtuse shortly 4-lobed stigma; capsule pendulous, 7–13 mm long, tapering at base, globose-pyriform, depressed at apex, distinctly 4-lobed, with obtusely keeled lobes, smooth, glabrous, green at first, later bright purple; seeds one in each cell, obovate, whitish, entirely enveloped by orange aril, altogether up to 10 mm long. May–June, Fr. July–October. (Plate XXX, Figure 1.)

Open forests, mostly oak and pine, usually at edges and in groves; shady ravines, alder stands and coastal shrubby formations; sometimes boggy habitats, once reported from solonchaks; often planted as hedges and fences. – European part: U. Dnp., M. Dnp., V.-Don (SW), Bes., Bl., Crim., L. Don; Caucasus: Cisc., Dag., W. Transc., E. Transc. (S. Transc.?), Tal. Cultivated specimens collected in Leningrad, Simferopol, Ufa, Omsk, Fergana. Gen. distr.: Scand., Centr. and Atl. Eur., W. Med., Bal.-As. Min. Described from W. Europe. Type in London.

Economic importance. *E. europaea* is of special interest because of the average yield of gutta-percha of its roots (4%). In this respect it comes after the slightly more prospective *E. maackii* which vicariates it in the Far East.

Its timber is yellowish, whitening in the air, odoriferous when fresh, light and of a low density (average specific weight 0.68); it is undoubtedly the most widely used of all the species of *Euonymus*, utilized in the production of spindles, knitting needles, toothpicks, cobbler's nails, etc. Its charcoal is loose and fine and in France is used to make gunpowder. This charcoal is especially valued for drawing because it is easily erased without leaving a trace. The fruits, like other parts of the shrub, have a highly disagreeable taste and even the smallest doses are effective in inducing vomiting and strong diarrhea, apparently because of the thick fatty oils in the seeds. The ground-up poisonous fruits are a popular external 555 means applied against parasites and rashes. The boiled capsules yield unstable colors – straw yellow with alums and brown with iron salts. The shrubs are often grown as simple ornamental plants, showy in fruit, which brighten up parks and gardens, and are also suitable for hedges.

2. *E. maackii* Rupr. in Bull. Phys.-Math. Acad. Petersb. XV (1857) 358.— *E. europaea* var. *hamiltoniana* Maxim. Mel. Biol. XI, 191 et in Bull. Acad. Sc. Petersb. XXVII (1881) 449.— *E. hamiltoniana* auct. Kom., Fl. Man'chzh. II (1904) 708, non Wall. 1824; Krisht. in B. Fedch., Fl. Az. Ross. V, 23.— *E. coreana* Levl. in Fedde Repert. sp. nov. VIII (1910) 284.— Ic.: Krisht. l. c. tab. 9; Kom. i Alis., Opreedel. rast. Dal'nevost. kr. 719, table 216, fig. 3.

Shrubs, 1–3 m high; branches orbicular-tetrahedral, glabrous, usually becoming black, ca. 1.5 cm thick and even thicker, with dark gray bark; buds small, ovoid-conical; leaves distinctly coriaceous, petiolate (petioles 6–18 mm long), rounded or rarely short-cuneate at base, ovate-rhombic or lanceolate, 3–9.5(15?) cm long, 1.2–5 cm wide, widest below middle, with mucro at apex usually more than $\frac{1}{7}$ of the blade, regularly serrate (the older often undulate), with hamate, abruptly mucronate, directed outward teeth. Cymes divaricately furcate for once or twice, 2–7(10)-flowered, on peduncles 1.5–3 cm long, upper 2 cymes at axils of longer but reduced lower leaves, the other 2–3 pairs at axils of deciduous scales; bracts and bracteoles remote from each other, squamiform, deciduous; flowers 4-merous, 10–12 mm in diameter; petals oblong-obovate, obtuse, whitish; stamens with 2.5–9 mm long filaments and dark purple anthers; ovary conical, glabrous; styles subcylindrical, obtuse, as long as stamens; capsule glabrous, pink-violet, rounded at base, globose-pyriform, 5–8 mm long, notched at apex, shortly 4-lobed with obtusely keeled, irregularly orbicular lobes; seeds entirely enveloped by orange aril. Fl. July, Fr. September. (Plate XXX, Figure 2.)

Shrubby formations, river valleys, river islands, shoals, coastal plains, also shores of lakes and seashores, nearly always alluvial sands, only sometimes dry ridges with open forests (the given species is strictly limited to sandy soils compared with the diverse habitats of the preceding species).— *E. Siberia*: cultivated in the vicinity of Irkutsk. Far East: Dau. (between the Gazimur and Argun rivers in the east), Ze.-Bu., Uda (only along the Amur between villages Orlovskoe and Nizhnetambovskoe), Uss. Gen. distr.: Jap.-Ch. (Manchuria and Korea). Described from Amur near the mouths of the Zeya and Bureya rivers. Type in Leningrad.

556 **Economic importance.** A prospective gutta-percha producing plant with a content of 6% in the roots, i. e., slightly more than the corresponding European *E. europaea*.

In its ornamental value it does not fall behind the latter species, even during fruiting; at flowering it has a unique combination of purple anthers against a background of white petals and nearly black-colored leaves and the conspicuous stems. Besides the Far East, where the species is already cultivated for this purpose, it can be recommended for the West. It should be tried for the fixation of sands, under conditions of sufficient moisture.

3. *E. sieboldiana* Blume, Bijdragen (1825) 1147; Shmidt., Sakhal. Fl. 132.— *E. hamiltoniana* var. *sieboldiana* Kom., Fl. Man'chzh. II (1904) 710; Krisht. in B. Fedch., Fl. Az. Ross. V, 25.—? *E. hians* Koehne in Gartenfl. LIII (1904) 33; Sugawara, Ill. Fl. Saghalien, 1273.— Ic.: Krisht. l. c. 24, fig. 10; Sugawara (*E. hians*) l. c. 1272, tab. 585.

Shrubs; leaves rounded or rarely broadly cuneate at base, elliptic or orbicular-oblong, 5–12 cm long, 4–7 cm wide, obtuse or abruptly sub-cuspidate, largely serrate with crenate teeth, coriaceous, glabrous above, more or less pubescent beneath along nerves. Cymes bi-trifurcate, for 2 or 3 times, 3–7-flowered, only the upper pair in axils of leaves; flowers 4-merous; stamens with short filaments and style short, or with long filaments and style short (heterostyly); capsule orange; seeds (in *E. hians* Koehne blood-red), entirely enveloped by bright red aril. June.

Far East: Sakh. (S.). Gen. distr.: Jap.-Ch. (Japan). Described from the Dutch Indies.

Note. We are provisionally including the dubious species *E. hians* Koehne, reported from S. Sakhalin by Sugawara, in the synonymy of *E. sieboldiana*. Unfortunately the characteristic color of the aril (bright red) and the seeds was not thoroughly examined in the series (Europaeae) as to whether it is a good diagnostic character for species delimitation; there is, however, every reason to believe that this trait is not very consistent and might be valuable only to separate garden varieties. The description of this form by Koehne from Japan is limited only to selected specimens of Japanese spindle-trees. Of the latter, only *E. sieboldiana* Blume corresponds to the characters indicated for *E. hians*. Especially supporting this identity is the fact that Sugawara ignores the occurrence of *E. sieboldiana* in "Flora yuzhnogo Sakhalina" (Flora of S. Sakhalin), while in an otherwise incomprehensible report he mentions *E. hians* for these localities.

557 Series 2. *Velutinae* Prokh. — See page 420 of the Key for characteristics of the series.

4. *E. velutina* (C. A. M.) Fisch. et Mey. in Bull. Soc. Nat. Mosc. XI (1838) 337; Ldb. Fl. Ross. I, 497; Boiss. Fl. or. II, 9; E. Bush in Mat. Fl. Kavk., ed. 35, p. 36; Krisht. in B. Fedch., Fl. Az. Ross. V, 22. — *E. europaeus* var. *velutinus* C. A. M. Verzeichn. (1831) 134. — Ic.: Krisht. l. c. tabl. 8.

Shrubs; branches rounded-tetrahedral or orbicular, smooth, velutinous-pubescent; buds small, ovoid-conical; leaves short-petioled (petioles 1–5 mm long), cuneate at base, elliptic or oblong-obovate, 1.5–8 cm long, 0.6–3.7 cm wide, widest above middle, obtuse or slightly acuminate, incurved, at margin, serrulate, somewhat coriaceous, ciliate above along the whitish midrib, otherwise glabrous, grayish-green, paler beneath and more or less uniformly hairy. Inflorescences umbelliform, composed of 2–4 rays on reduced peduncle, 0.5–2.5 cm long, always about half as long as leaf, all in axils of branch leaves except for the upper pair; bracts thin, filiform, 1–4 mm long, rarely elongating, lanceolate and up to 14 mm, usually long persistent; bracteoles at base of pedicels near to bracts, squamiform, persistent; flowers 4-merous, 8–10 mm in diameter; sepals 0.75–1 mm wide; petals whitish, oblong, ca. 3 mm [?] long, 1.5–2 mm wide, rounded at apex, stamens with filaments 2–2.5 mm long; ovary conical, pubescent; style filiform, slightly shorter than stamens; capsule slightly tapering at base, pyriform, 10–12 mm long, depressed above, deeply 4-lobed, with orbicular winged lobes, velutinous-pubescent; seeds ovate, entirely enveloped by orange aril. Fl. May–June, Fr. July–August.

Shrubby formations, mountain slopes of light forests, valleys. — Caucasus: E. Transc. (Shusha), Tal.; Centr. Asia: Mtn. Turkm. (only Ioldere gorge and Syunt Mountain). — **Gen. distr.:** Iran. (N. Iran). Described from Lenkoranka stream between Lenkoran and Zuvant. Type in Leningrad.

Section 3. MELANOCARYA (Turcz.) Nakai in Journ. Jap. Bot. XVII, 11 (1941) 618; Acta Phyt. et Geob. XII, 30. — *Melanocarya* Turcz. in Bull. Soc. Nat. Mosc. XXXI, 2 (1858) 453. — For characteristics of the section see page 420 of the Key.

5. *E. sacrosancta* Koidz. in Tokyo Bot. Mag. XXXIX (1925) 12. — *E. alata* auct.; Maxim. Pr. Fl. Amur. (1859) 73, non Thunb. — *E. alata* var. *pubescens* Maxim. (Mel. Biol. XI, 197) in Bull. Acad. Sc. Petersb. XXVII (1881) 454; Kom. Fl. Man'chzh. II, 703; Krisht. in B. Fedch., Fl. Az. Ross. V, 17; Sugawara, Ill. Fl. Saghalien, 1271. — Ic.: (*E. alata*) Krisht. l. c. 18, tab. 5; Sugawara, l. c. 1270. tab. 584; Kom. and Alis., Opre del. rast. Dal'nevost. kr. 719, tabl. 216, fig. 2.

- 558 Shrubs; low, branching plants, with pale gray striped bark; juvenile branches orbicular-tetrahedral, later with 4 longitudinal opposite wings, wings equal, thin, brittle, corklike, 3–6 mm wide, sometimes branches (in the shade?) completely wingless; buds ovoid, 1–2 mm long, with rusty, scarious, marginal scales; leaves hardly petiolate, cuneate at base, subrhombic-obovate or broadly elliptic, 3–8(9) cm long, 1.5–4(5) cm wide, abruptly cuspidate or obtusely acuminate, dark green and glabrous above, paler beneath, more or less densely pubescent along nerves, serrulate, usually with outwardly recurved mucronate teeth. Inflorescences in axils of small, soon deciduous leaves, simple, short, 3-furcate, on reduced peduncles, usually only the central flower developing; bracts squamiform, dry; flowers 4-merous, 6–8 mm in diameter; petals orbicular, 2–2.5 mm long, greenish-white, fimbriate-ciliate at margin; stamens with short but distinct filaments; capsule divided to base, usually only 1 or 2 nearly free lobes developed from the initially 4-locular ovary, lobes elliptic, dehiscent, 1-locular; seeds solitary, on distinct stalks, rufous, entirely enveloped by bright red round aril. Fl. May–June, Fr. August. (Plate XXX, Figure 3.)

Mixed forests, undergrowths, shrubby formations, felled oak thickets, hazel groves, rocky slopes, river valleys, mountainous streams. — Far East: Ze.-Bu. (only near Blagoveshchensk and along the Amur between Ust-strelochnoi and the mouth of Zeya River), Uss., Sakh. (including the Kurile Islands). **Gen. distr.:** Jap.-Ch. (Manchuria, China — Chihli, Shantung), N. Korea, rarely in Japan. Described from Ominosan Mountain along the Zenkoji River in the former province of Shinano, Honshu Island, Japan, possibly from a cultivated specimen as indicated by the name. Type in Tokyo.

Economic importance. An interesting ornamental shrub in parks and gardens.

Note. Up till now this species has been identified with the widespread Japanese *E. striata* (Thunb.) Loes., also known as *E. alata* (Thunb.) Rupr.; it is easily distinguished from the latter by the conspicuous pubescence beneath the leaves, the serrulate-subfimbriate margin, and the different shape of leaf blade. Being very rare in Japan it vicariates within the borders of the Soviet Far East and adjacent Manchuria with the typical for Japan *E. striata* (Thunb.) Loes.

Section 4. *KALONYMOPSIS* Prokh. sect. nova in Addenda XIII, 744. — ? *Pseudovyenomus* Nakai in Journ. Jap. Bot. XVII, 11 (1941) 617; Acta Phyt. et Geob. XIII, 31. — For characteristics of the section see page 420 of the Key. Type of section: *E. verrucosa* Scop.

559 Series 1. *Semenovianae* Prokh. — See Key. Type of series: *E. semenovii* Rgl. et Herd.

6. *E. semenovii* Rgl. et Herd. in Bull. Soc. Nat. Mosc. XXXIX (1865) 557; Krisht. in B. Fedch., Fl. Az. Ross. V, 201. — *E. europaea* var. *semenovii* Rgl. in Tr. B. S. IV (1876) 321; Krasnov, Opyt istorii rasvitiya flory yuzhnoi chasti vost. Tyan'-shanya, 376. — Ic.: Krisht. l. c. 21, tabl. 7.

Branching shrubs; branches subtetrahedral, often narrowly winged, smooth, olive-green, the older rounded, irregularly striate, with 4 longitudinal, opposite, narrow grayish wings; buds small, acuminate; leaves rounded or rarely slightly attenuate at base — ovate-lanceolate or narrowly lanceolate, 1.5–6 cm long, 0.5–2 cm wide, widest below middle, acute (but without mucro), flat at margin, crenate-serrate, rather thick, glabrous, yellowish-green. Inflorescences bi- or trifurcate for 1–3 times, usually 3–7-flowered (rarely more), on thin peduncles, 0.8–2.5 cm long, fasciculate at axils of coriaceous mucronate scales at base of shoots; bracts and bracteoles approximate, persistent, ovate, acuminate, somewhat coriaceous, brownish; flowers 4-merous, 6–8 mm in diameter; petals oblong-orbicular, dark purple with greenish margin; stamens with sessile whitish anthers; capsule pyriform, 6–9 mm long, obtusely 4-lobed, tapering at base to a short neck; seeds 1–2 in each cell, ovate, dark brown, only partly enveloped by bright orange-red aril with lateral gap. Fl. May–June, Fr. August.

Shady places in river valleys and along ravines, rocks, taluses and stony slopes of spruce forests, sometimes in thickets of Central Asian juniper or nut forests. — Centr. Asia: Dzu.-Tarb. (sources of Karatal River, Arasan Mountain), Pam.-Al. (Dzhusala and Ak-Bura rivers), T. Sh. Gen. distr.: Dzu.-Kash. (Tien Shan mountain system). Described from Dzhenishke River at the foot of the Ak-Kiya mountain pass near Alma-Ata. Type in Leningrad.

Series 2. *Verrucosae* Prokh. — See Key. Type of series: *Euonymus verrucosa* Scop.

7. *E. verrucosa* Scop. Fl. carn. ed. 2, 1 (1772) 166; Ldb. Fl. Ross. I, 498; Boiss. Fl. or. II, 9; E. Bush in Mat. Fl. Kavk., ed. 35, 37. — Ic.: Schlecht. Lang. u. Schenk, Fl. Deutschl. 5 Aufl. tab. 2180; Syreishch., III. Fl. Mosk. gub. II, 346. — Exs.: G.R.F. No. 863; Fl. exs. austro-hung. No. 3646.

560 Shrubs, 1–2 m high; branches rounded, densely black-brown-furrowed; buds ovoid-conical, 1–4 mm long, with brown-scarious scales; leaves short-petiolate (petioles 1–3 cm [?] long), rounded at base, ovate or elliptic-oblong, 1.5–9 cm long, 0.8–5.5 cm wide, usually widest below middle, acute or obtuse, sometimes short-mucronate, crenate-serrate, with gnawed teeth, pale green, glabrous, only rarely short-ciliate beneath along nerves. Inflorescences once or twice 3-partite, 3–9-flowered, on thin, 2–8 cm long peduncles usually longer than the subtending reduced leaves of shoots, lateral pedicels spreading, twice as long as the median; bracteoles falling immediately after bracts at flowering; flowers 4-merous, 6–10 mm in diameter; calyx 4-lobed, with thick, slightly rugose lobes; petals suborbicular, greenish with violet spots; stamens with whitish sessile anthers; capsule more or less rounded at base, flattened-pyriform, 5–8 mm long, shortly and obtusely 4-lobed, smooth, wax-yellow, glabrous; seeds ovate, black, half-enveloped by loose, dirty-red, rugose aril becoming brown when dry. Fl. May–July, Fr. July–October. (Plate XXX, Figure 4.)

Broadleaved and conifer forests, sometimes swamp forests, rarely shrubby formations, usually along river valleys and ravines. — European part: Lad.-Ilm. (only Pskov and Ostrov districts), U. V., V.-Kama (southern part), U. Dnp., V.-Don, Transv., Bes., Bl., Crim., L. Don; Caucasus: Cisc., Dag., W., E. and S. Transc. (north). Grown in some localities, in Altai for example, for gutta-percha. Gen. distr.: Scand. (S.), Centr. Eur., Bal.-As. Min. Described from Carniola in the Balkans.

Note. This species is common only to the eastern part of Europe and is the most widespread of all the species of *Euonymus* in the USSR, extending far to the northeast.

Economic importance. In the Soviet Union there are plants producing an average of 7% gutta-percha, often reaching 10% and sometimes as high as 15%. Root collection in natural plantings is the current method of exploiting the species. In view of the destruction of its natural resources, *E. verrucosa* is now being widely planted, in spite of the many difficulties involved (notably germination of seeds).

This species is apparently similar to *E. europaea* in character but not as suitable for use because of its smaller measurements. It deserves special attention, as a substitute for the European species, at least where it appears to be the only representative of the genus.

8. *E. pauciflora* Maxim. Prim. Fl. Amur. (1859) 74; Kom. Fl. Man'chzh. II, 705; Krisht. in B. Fedch., Fl. Az. Ross. V, 19. — *E. verrucosa* var. *pauciflora* Rgl. Tent. fl. Ussur. (1861) 41; 561 Maxim. in Mel. biol. XI, 195. — Ic.: Krisht. l. c. tabl. 6; Kom. and Alis. in Opred. rast. Dal'nevost. kr. 719, tabl. 216, fig. 1.

Shrubs, 0.5–2 m high, strongly branching, with dark bark; buds ovoid-conical, 1.5–3 mm long, with few brown-scarious scales; leaves short-petiolate (petioles 1.5–5 mm long, pubescent), cuneate, sometimes rounded

at base, oblong-obovate or elliptic, 2.5–10 cm long, usually widest below middle, obtuse and abruptly mucronate at apex, rarely gradually acuminate, sparingly short-hairy above, more or less densely hairy beneath, especially along nerves, acutely serrulate, with entire bristly-ciliate teeth. Cymes short, of 1–3 rays, lateral pedicels longer, spreading, simple, very rarely bifurcate, sometimes one of the lateral pedicels absent or often the median one reduced, 1–3(5)-flowered, on thin, 2–4 cm long peduncles, in axils of all leaves of branch except for the lower reduced pair of leaves, median leaves nearly twice as long as inflorescence, the upper slightly so; bracts and bracteoles small, squamiform, brown-scarious, persistent at flowering; flowers 4-merous, 5–8 mm long; petals suborbicular, purple, grayish at margin; stamens with sessile anthers; capsule pink, smooth, narrow obconical at base, pyriform, obcordate at cross section, 5–10 mm long, deeply 4-lobed, with narrow acutely keeled lobes; seeds black, compactly enveloped for only half by smooth, constantly (even when dry) orange aril. Fl. May–June, Fr. August–September.

Mixed forests, thickets of shrubs, stony slopes, oak forests. — Far East: Ze.-Bu. (north up to the basin of Byssa River), Uda (only along Amur near Poddal and Dzifu at Khungari River), Uss. Gen. distr.: Jap.-Ch. (only Manchuria). Described from Poddal and Dzifu at the lower Amur. Type in Leningrad.

Economic importance. Apparently similar to the preceding species.

9. *E. nana* M.B. Fl. taur.-cauc. III (1819) 160; Ldb. Fl. Ross. I, 499; Boiss. Fl. or. II, 9; E. Bush in Mat. Fl. Kavk., ed. 35, 45. — *E. caucasica* Lodd. ex J.C. Loudon, Arbor. et Frutic. Brit. IV (1858) 2545. — Ic.: Hayek, Pflznd. Oest.-Ung. I, 415, f. 233; O. Stapf in Curtis, Bot. Mag. CLVI, tab. 9308. — Exs.: G. R. F. No. 914.

562 Shrubs, 0.3–1 m high (in Mongolia up to 2 m); stems either as underground rhizomes long and woody, or creeping, rooting, bearing numerous ascending or erect shoots; branches at first thin, multiangular-ribbed and longitudinally furrowed, greenish, later becoming gray or black with the many longitudinal verrucose lenticels, more or less densely leafy; buds small, orbicular-ovoid; leaves irregularly alternate, the upper in whorls of 3, sometimes nearly or completely opposite, short-petiolate (petioles 1–3 mm long), cuneate or rarely rounded at base, spatulate-linear or linear-oblong or rarely oblong-elliptic, 0.8–4 cm long, 1–4(8) mm wide, widest at middle or slightly above, rounded or truncate at apex, sometimes notched, rarely acuminate, usually mucronulate, coriaceous, evergreen, bright green above, with depressed midrib, glaucescent beneath, incurved at margin and obscurely serrate (with hydathodes). Flowers solitary or in 2–3-flowered cymes, on thin greenish peduncles 0.5–2 cm long, in axils of longer leaves or of acutely dentate scales, 4-merous, 6–8 mm in diameter; pedicels filiform, 0.5–2 cm long, reddish, jointed above base and bracteolate; bracts larger than bracteoles, subulate, ca. 1 mm long, red; calyx yellowish, red-dotted, divided into fleshy orbicular lobes ca. 1 mm in diameter; petals ovate-orbicular, 1.5–2 mm long, ca. 1.5 mm wide, greenish and brown-red, densely red-dotted; disk ca. 2 mm in diameter, greenish; stamens with sessile yellowish anthers, 0.75 mm long; ovary obtusely conical, ca. 1 mm in diameter, with sessile capitate stigma; capsules pendulous, pyriform,



PLATE XXX. 1-*Euonymus europaea* L.; 2-*E. maackii* Rupr.; 3-*E. sacrosancta* Koidz.; 4-*E. verrucosa* Scop.; 5-*E. nana* M.B.; 6-*E. koopmanni* Lauche.; 7-*Kalonymus latifolia* (Mill.) Prokh.; 8-*K. maximowicziana* Prokh.; 9-*K. sachalinensis* (F. Schmidt) Prokh.; 10-*K. leiophloea* (Stev.) Prokh.

9–12 mm long, ca. 10 mm wide, 4-lobed, 4-valvate, pale yellow or partly green, partly or completely becoming pink; seeds 2 in each cell, exserted from the ripe capsule, subglobular, ca. 3 mm in diameter, shiny, dark red, embedded in fleshy rugose orange aril (up to 1 mm long). Fl. July, Fr. August–September. (Plate XXX, Figure 5.)

In the west (Ukraine) in broadleaved forests and shrubby formations in plains and foothills not higher than 800 m (Moldava River), slopes and valleys; further to the east (Caucasus, Mongolia) in conifer mountainous forests and shrubby thickets on rocky slopes at altitude of 2,000–2,800 m. Tertiary relict with interestingly interrupted distribution area. — European part: U. Dns. (Bukovina, upper reaches of Moldava River; along Zbruch River at the right bank near Kichimov and at the left bank near Samanov), Bes. (Korneshty), Bl. (talweg ravine in Kimla, Chutyanskii forestry, former Aleksandrovskii district); Caucasus: Cisc. (sources of the Kuban River near Khuruzuka, Besh-Tau Mountain, around Konstantinovskie hot springs near Pyatigorsk). Gen. distr.: Mongolia (Alashan Mountains), Tib. (Kansu province along the river Ta tung ho). Described from N. Caucasus, Konstantinovskie hot springs near Pyatigorsk. Type in Leningrad.

565 **Note.** A form of this species grows in Mongolia and differs from the Caucasus plant only by being slightly higher and having predominantly whorled and opposite leaves; however, this still does not justify its separation into an independent species. In the Ukraine and the Caucasus *E. nana* rarely bears fruit, but in Mongolia fruiting is common.

Economic importance. Of interest as an exquisite, fruit-bearing, simple ornamental plant. Becoming pendulous in habit after grafting with European specimens.

10. *E. koopmanni* Lauche in Gartenzeit. Berl. II (1883) 111. — *E. nana* var. *koopmanni* Dippel ex Beissner in Beissn. Schelle u. Zabel Handb. Laubh.-Benenn. (1903) 294. — *E. nana* var. *turkestanica* Krysht. in B. Fedch., Fl. Az. Ross. V (1914) 28. — Ic.: Lauche, l. c. tab.

Evergreen shrubs, low, glabrous; stems creeping, underground as a rhizome or rooting aboveground, bearing ascending or erect shoots; branches at first thin, multiangular and convexly-ribbed, sometimes with ribs slightly winged, longitudinally furrowed, greenish, rather densely leafy, the older gray or black in lower part, with many longitudinal furrows; buds orbicular-ovoid, ca. 2 mm long; leaves irregularly alternate, the upper in whorls of 3 or 4, sometimes more or less opposite, short-petiolate (petioles 1–3 mm long), distinctly cordate, often dilated at base, narrowly lanceolate or linear-lanceolate, 1.5–7.2 cm long, 0.2–1.3 cm wide, usually widest below middle, rounded or obtuse at apex, sometimes mucronulate, coriaceous, green and shiny above, paler, glaucescent, beneath, incurved at margin, subacutely serrate, also sparsely and shortly crenate. Flowers solitary or in 2–3-flowered cymes, in axils of leaves exceeding inflorescence, 4-merous; bracts squamiform, entire; capsule pendulous, shortly obconical at base, pyriform, 10–15 mm long, 4-lobed, with lobes keeled or bordered by narrow round wing, smooth, yellowish-green or often more or less pink; seeds 2 in each cell, exserted from the ripe capsule, oblong-orbicular, 4.5–5 mm long, shiny, lilac, smooth, covered by broad, saucer-shaped, orange aril only at the lower $\frac{1}{3}$. Fl. June, Fr. August–September. (Plate XXX, Figure 6.)

Stony slopes in river valleys and ravines, shady places in forest or shrubby thickets. — Centr. Asia: Pam.-Al. (Gul'cha, Argash River), T. Sh. (Fergana Range, Chatkal-Tau, Talass Ala-Tau in the west). Endemic. Description based on specimens grown by Lauche in the gardening school near Potsdam and originally obtained from B. Koopman, director of the botanical garden in Margelan; the latter had collected the seeds on Alai Range in the southern part of Fergana.

Note. This species is closely related to the preceding. Its insular distribution in Central Asia connects the two disjunct areas of that species, one in the Northern Caucasus and the other in China. Many consider it a variety of the Caucasian-Ukrainian population of *E. nana* M.B. being morphologically more distinct but spatially less remote than the almost identical but much more remote Mongolian-Chinese population.

Economic importance. An exquisite ornamental shrub which deserves as much attention as the preceding species.

Genus 867. **KALONYMUS** (G. Beck) Prokh.

Kalonymus (G. Beck) Prokh. gen. novus in Addenda XIII, 744. — Generis *Euonymi* subgen. *Kalonymus* G. Beck, Fl. v. Nied.-Oesterr. (1892) 588. — Generis *Euonymi* sect. *Uniloculares* Rouy et Foucand, Fl. Fr. IV (1897) 159. — Generis *Euonymus* subgen. *Turibana* Nakai in Acta Phyt. et Geob. XIII (1943) 31. — Typus generis: *Euonymus latifolia* Mill.

Flowers flat, bisexual, commonly 5-merous, rarely 4-merous, in simple or compound cymose inflorescences, cymes long-pedunculate in axils of developed leaves, with basal bracts on cyme and bracteoles at pedicels; sepals spreading or recurved; petals horizontal, orbicular or oblong, greenish-white, rarely purple, entire or fimbriate; disk large, wide, slightly (4-)5-lobed; stamens at upper margin of disk; filaments nearly absent, tubercle-like; anthers monothecal due to fusing of pollen cells on opening; ovary gradually passing into disk or embedded in it, (4-)5-locular; styles usually short, with entire or slightly (4-)5-lobed stigma; capsules developed from only part of flowers of inflorescence, coriaceous, bright orange, 5- (rarely 4-) locular with as many lobes, lobes usually extending into more or less long wing without relics of style above; seeds 1 or 2 in each cell, pendulous at inner margin of valve wall, with coriaceous testa and entirely enveloped by bright orange fleshy aril. Unarmed erect shrubs or trees, glabrous, with smooth usually rounded branches; leaves opposite, scarious or coriaceous, deciduous or long persistent and evergreen, serrate or entire, short-petiolate, with deciduous filiform stipules. Type of genus: *Euonymus latifolia* Mill.

Note. The genus *Kalonymus* is separated here for the first time. A similar attempt was first made by Beck in 1892, who proposed the name *Kalonymus*; he described a wide array of important characters, in spite of which he only provisionally (i.e., not actually) noted the genus *Kalonymus* and published it merely as a subgenus of the genus *Euonymus*, based on the type species *E. latifolia* Mill.

The pendulous and not erect ovules, the 1-locular anthers and the 5-merous flowers could serve as significant characteristics not only of a genus but even of a family, thus we rank Beck's subgenus as an independent genus.*

Nevertheless, a precise delimitation of the species of *Kalonymus* according to the indicated characters as distinct from the genus *Euonymus* is especially needed in China and N. America.

Economic importance. The species of *Kalonymus* distinctly fall behind the proper species of *Euonymus* in gutta-percha yield. Only *K. latifolia*, with a gutta content in the roots of about 4% may be of some interest in this connection. The following species proved to be poor in content of gutta-percha: *K. maximowicziana* (3%), *K. macroptera* (1.5%) and ? *K. leiophloea* (less than 1%). It is strange that *K. leiophloea*, which is so close to the sympatric *K. latifolia*, differs so markedly in its insignificant yield of gutta-percha.

The relatively poor yield of gutta-percha of the species of *Kalonymus* is an indication of the progressive character of the whole genus in comparison with *Euonymus*.

The species of *Kalonymus*, with their bright fruits and seeds amidst a background of dense dark leaves, are of some interest as ornamentals.

1. Capsule globose, not lobed (series *Oxyphyllae*); leaves acutely serrate with teeth curved upwards 1. *K. yesoensis* (Koidz.) Prokh.
- + Capsule lobed and winged as well: lobes elongating into wings 2.
2. Capsule usually 5-lobed, 5-locular, lobes with wings slightly longer than width of cells; flowers generally not large 3.
- + Capsule usually 4-lobed, 4-locular, lobes with wings much longer than width of cells; flowers mostly small (series *Macropterae*) 5.
3. Cymes simple, usually 3-flowered; corolla purple (series *Occidentales*); leaves obtuse, largely crenate, with round serrulate teeth 4. *K. sachalinensis* (F. Schmidt) Prokh.
- + Cyme usually compound, with 3-5 rays, the lateral rays once or rarely twice 2-5-branched; corolla greenish-white; leaves serrate or subentire (series *Latifoliae*) 4.
- 568 4. Leaves obtuse or short-acuminate, obscurely serrulate, often subentire; peduncles thin, pendulous; capsule with trapeziform, horizontal wings 2. *K. latifolia* (Mill.) Prokh.
- + Leaves long-cuspidate, usually irregularly distinctly serrate, with gnawed-crenate teeth; peduncles erect, not thin; capsule with short orbicular-triangular slightly hairy wings 3. *K. maximowicziana* Prokh.
5. Leaves rounded or even truncate at base, obtuse or rounded at apex, rarely with short mucro, faintly crenate-serrate, sometimes entire especially in upper part; peduncles flexuose, thin; capsule with wings hardly erect 5. *K. leiophloea* (Stev.) Prokh.
- + Leaves cuneate at base, slightly obtuse and abruptly mucronate at apex, regularly serrulate; peduncles erect, not thin; capsule with distinctly erect wings 6. *K. macroptera* (Rupr.) Prokh.

* The recognition of this group of spindle-trees as a separate genus is still not sufficiently proven. - Editorial Board.

Series 1. *Oxyphyllae* Prokh. — For characteristics of the series see page 433 of the Key. Type of series: *Euonymus oxyphylla* Miq.

1. *K. yesoensis* (Koidz.) Prokh. comb. nova. — *Euonymus yesoensis* Koidz. Fl. Symb. Orient.-Asiat. (1930) 13; Sugawara, Fl. Saghalien, 1277. — Ic.: Sugawara, l. c. 1276, tab. 587.

Shrubs or trees; branches rather large, glabrous; smooth; buds 10–11 mm long, comparatively thick, acute; leaves rounded or cuneate at base, ovate or elliptic, 5–10 cm long, 2.5–4.5 cm wide, acute (not acuminate and not mucronate), acutely serrate, with teeth outcurved, scarious, glabrous; petioles short, smooth. Cymes pendulous, 10–20 cm long, glabrous; pedicels 3–4 mm long; flowers 5-merous, 9 mm wide; calyx with short suborbicular lobes; petals broadly elliptic, yellowish, slightly dark purple at base; disk fleshy, 5-lobed; anthers subsessile; style very short; capsule globose, 14 mm in diameter.

Forests? — Far East: Sakh. (S.). Gen. distr.: Jap.-Ch. (E.). Described from Hakodate on Hokkaido Island. Type in Tokyo.

Note. Apparently not present in the collections of the Herbarium of the Botanical Institute. Indicated for Sakhalin on the basis of Sugawara's report (1940).

Series 2. *Latifoliae* Prokh. — For characteristics of the series see page 433 of the Key. Type of series: *Euonymus latifolia* Mill.

569 2. *K. latifolia* (Mill.) Prokh. comb. nova. — *Euonymus latifolia* Mill. Dict. ed. 8 (1768) No. 2; Scop. Fl. carn. ed. 2, I, 165; Ldb. Fl. Ross. I, 498; Boiss. Fl. or. II, 10; E. Bush in Mat. Fl. Kavk. ed. 35, 41. — Ic.: Schlecht., Lang. u. Schenk, Fl. Deutschl. 5 Aufl. (1885) tab. 2181; Hegi, Ill. Fl. V, 1 (1923) 254. — Exs.: (*Euonymus latifolia*), G. R. F. No. 609; Fl. exs. austro-hung. No. 285.

Shrubs or trees, 2–5 m high, glabrous; branches long, smooth, rounded or slightly flattened at top, the juvenile ones yellowish-green soon becoming dull, the older somewhat shiny, grayish-brown, faintly striate, beset with small black lenticels; buds long-fusiform, terminal and lateral, the upper lateral elongated at base, 5–15 mm long, with scales narrowly pale coriaceous and fimbriate at margin; leaves cuneate or rarely rounded at base, elliptic or oblong-obovate, 4–14(21) cm long, 1.5–6(7.5) cm wide, the lower sometimes obtuse, otherwise short-acuminate, obscurely serrulate, sometimes subentire, scarious, deciduous, paler beneath, with yellowish midrib and arcuate lateral ribs; petioles 5–20 mm long, canaliculate. Inflorescences cymose, forming dichasium or terminal umbel of 3–5 rays, the median simple and the lateral often once or twice 3–5-branched, 7–21-flowered, on thin elongated (up to 15 cm) peduncles pendulous in fruit, in axils of lower leaves, subtending leaves only rarely not reaching length of peduncles; pedicels diverging, about as long as flowers, with pair of squamiform bracteoles below the middle, deciduous like bracts; flowers commonly 5- (rarely 4-) merous, 7–9 mm in diameter; calyx 5-(4-) partite,

with obovate or suborbicular, relatively large (1–2 mm long, 1–1.5 mm wide) short-ciliate lobes; petals oblong-orbicular, 2.5–3.5 mm long, 2–3 mm wide, rounded at apex, greenish-white, sometimes slightly brownish in places, crenate at the recurved margin; stamens with tubercle-like filaments and subsessile 1-locular anthers; styles markedly reduced, obtuse, with capitate, faintly 5-(4-)lobed stigmas; capsules pendulous on reddish stalks, more or less globose, 9–15 mm long, 20–25 mm wide, flattened, lobes (4)5, laterally compressed passing into narrow orbicular-trapeziform wing (4–7 mm long), smooth, purple-red when ripe; seeds oblong-ovate, ca. 7 mm long, whitish, entirely enveloped by smooth saffron-orange aril, with distinct micropyle. Fl. May, Fr. August–September. (Plate XXX, Figure 7.)

Shady mountain forests (usually beech and spruce), shrubby thickets, slopes, valleys, ravines. — European part: Crim.; Caucasus: Cisc., Dag., W., E. and S. Transc., Tal. Gen. distr.: Centr. and Atl. Eur., Med., Bal.-As. Min., Iran. (W.). Described from Hungary (Pannonia) and Austria.

570 **Economic importance.** In its uses this species is reminiscent in many respects of other spindle-trees, the European types for example. The broadleaved *Kalonymus* is not without value as a source of gutta-percha, surpassing (4%) many species of *Euonymus*. The relatively large measurements of the given shrub make it far more suitable for making articles than the true spindle-tree. With its bright fruits and seeds it is an effective ornamental garden plant.

3. *K. maximowicziana* Prokh. sp. nova in Addenda XIII, 744. — *Euonymus erosidens* Prokh. nomen altern. — *E. sachalinensis* auct.; Maxim. p. p. (characters of the leaves, and specimens, except the Sakhalin) in Bull. Acad. Sc. Petersb. XXVII (1881) 446; Kom., Fl. Man'chzh. I, 712, p. p.; Krisht. in B. Fedch., Fl. Az. Ross. V, 27 [non *E. sachalinensis* (F. Schmidt) Maxim.]. — Ic.: Krisht. l. c. tabl. 12.

Shrubs, up to 3 m high, with stem up to 5 cm thick; branches procumbent, often twisted, not long, annotinous striate, 1–2 mm in diameter, the older thick-cylindrical, dark brown, with scattered white lenticels and layers of brown bark, 2–5 mm thick, glabrous; buds in the fall large, 8–20 mm long, fusiform, conical-acuminate; leaves rounded or short-cuneate at base, elliptic-rhombic or ovate, rarely oblong-obovate, 3.5–11.5 cm long, 2–6 cm wide, usually widest below middle, abruptly more or less long-acuminate, distinctly but usually irregularly fimbriate-serrate, with gnawed-crenate teeth, scarious, glabrous, paler beneath; petioles 4–9 mm long. Cymes of 5 (rarely 3) rays, (3)9–21-flowered, but not producing more than 3 capsules, on not thin peduncles (2)5–9 cm long, in axils of lower leaves approximately as long as peduncles, or in axils of deciduous scales, median ray simple, lateral rays adjacent, once or rarely twice 2–3-branched, the outermost simple, rarely branched; bracts and bracteoles deciduous; flowers commonly 5-merous, rather small, 4–5 mm in diameter; petals oblong-orbicular, 1.5–2 mm long, greenish-white, more or less hairy at margin; stamens with subsessile anthers; styles markedly reduced, obtuse, with disciform stigma; ovary hardly inflated, yellowish; capsule pendulous, flattened-globose, stellately tetrahedral-pentahedral, 7–12 mm long, 10–17 mm wide, convex above, flat below, with 5 (rarely 4) short orbicular-triangular sparingly pubescent

wings not exceeding half the length of cells, dark orange-brown; seeds oblong, 6–7 mm long, completely enveloped by yellowish aril. Fl. May, Fr. August. (Plate XXX, Figure 8.)

571 Mixed forests and coastal bluffs. — Far East: Uss. (coastal belt and adjacent islands, from Pos'et Bay to Vladimir Bay and beyond (44–50° N), in addition only near the frontier of Stepanovka in Shmakova District and along the Suifun River between Ninguta and Voroshilov). Gen. distr.: Jap.-Ch. (Manchuria). Described from Pos'et. Type in Leningrad.

Series 2. *Occidentales* Prokh. — For characteristics of the series see Key on page 433.

4. *K. sachalinensis* (F. Schmidt) Prokh. comb. nova. — *Euonymus sachalinensis* (F. Schmidt) Maxim. p. p. (characters of flower and specimens from Sakhalin in Bull. Acad. Sc. Petersb. XXVII (1881) 446, nomen altern.; Kom., Fl. Man'chzh. II, 712, p. p.; Sugawara, Ill. Fl. Saghalien, 1279. — *E. latifolius* var. *sachalinensis* Fr. Schmidt, Sakhal. Fl. (1868) 121. — Ic.: Sugawara, l. c. 1278, tab. 588.

Shrubs; branches rounded, striate, longitudinally rugose, brown, glabrous; buds large, 5–22 mm long, fusiform, acuminate; leaves scarious, glabrous, cuneate or sometimes (the larger leaves) rounded at base, obovate or elliptic, 3–11 cm long, 2–9 cm wide, usually widest above middle, obtuse or with small short mucro at apex, largely crenate-serrate, with round usually serrulate teeth, on 5–10 mm long petioles. Cymes usually simple, of 3 (rarely 2 or 4) rays (only rarely some rays 2-branched), 2–4-flowered, on thin pendulous peduncles (3–6 cm long), 2 or rarely 4 in axils of deciduous paired basal scales, twice as long as the higher leaves; bracts and bracteoles subulate, all deciduous; flowers 5-merous, (5)8–10 mm in diameter; petals spatulate-obovate, cuneately tapering to claw, obtuse, purple; stamens with subsessile anthers; styles obtusely reduced, with subsessile stigma; ovary hardly inflated; capsule flattened-globose, 8–12 mm long, 19–25 mm in diameter, convex above, flat below, stellately 5-lobed, with lobes continuing as short orbicular-oblong wings not exceeding length of cells; seeds completely enveloped by orange aril. Fl. May–July, Fr. July–October. (Plate XXX, Figure 9.)

Mountain forests, mainly conifer. — Far East: Sakh. Gen. distr.: Jap.-Ch., (Japan: Hokkaido Island and Fujiyama Mountain). Described from Due Port on Sakhalin Island. Type in Leningrad.

Note. Maksimovich made the wrong decision in combining two very different species under the name "*Euonymus sachalinensis*," one of them from the southern Maritime Territory and the other from Sakhalin Island. He promoted *E. latifolia* var. *sachalinensis* F. Schmidt from Sakhalin to the rank of a species, under the name *E. sachalinensis* (F. Schmidt) Maxim., although all the herbarial specimens cited and the described characters of the leaves correspond to the mainland population.

572 Still Maksimovich does list in his catalogue Schmidt's specimens from Sakhalin, and notes in his diagnosis the violet color of the corolla not characteristic of the mainland specimens, and in one case in his own handwriting he

marks one Sakhalin specimen, even though as a variety, under Schmidt's name. All this combined gives us the right to affix the name *E. sachalinensis* (F. Schmidt) Maxim. to the Sakhalin species.

Series 3. *Macropterae* Prokh. — For characteristics of the series see Key on page 433. Type of series: *Euonymus macroptera* Rupr.

5. *K. leiophloea* (Stev.) Prokh. comb. nova. — *Euonymus leiophloea* Stev. in Bull. Soc. Nat. Mosc. XXIX, 2 (1856) 122 in textu; E. Bush in Mat. Fl. Kavk. ed. 35, 40. — *E. sempervirens* Rupr. ex Boiss. Fl. or. II (1872) 10.

Glabrous shrubs; branches rounded, smooth, the annotinous yellowish with black lenticels, the developed branches grayish-brown; buds ovoid-conical, 2–10 mm long, with pale scales brown around; leaves distinctly petiolate (petioles not winged, 3–5 mm long), rounded or even truncate at base, elliptic or obovate or oblong, 2.5–7 cm long, 1.5–4 cm wide, widest usually at the middle, obtuse or rounded at apex, rarely short-mucronate, faintly crenate-serrate, sometimes subentire above, scarious, usually pale. Cymes 5-rayed, loose, many-flowered (up to 21), with central ray simple and short, the adjacent lateral once or twice 3-branched, marginal rays simple or once–twice 3-branched, arranged on long thin flexuose peduncles at axils of deciduous scales, sometimes also at the lower pair of shoot-leaves; flowers 4-merous, ca. 5 mm in diameter; sepals orbicular, 1–1.5 mm long; petals oblong-orbicular, 2–2.5 mm long, greenish-white; stamens with subsessile anthers; capsule flattened-disciform, 4–5 mm long, cruciformly 4-lobed, lobes with erect linear wings gradually acuminate or sometimes, conversely, tapering at base, 10–15 mm long; seeds entirely enveloped by orange aril. Fl. April–June, Fr. August–September. (Plate XXX, Figure 10.)

Shady places and forests, stony slopes of ravines and river valleys. — Caucasus: W. Transc., E. Transc. (in the west). Endemic. Described from "Lira" sources, i. e., Kura River in Guriel' (Guria Mountains). Type in Helsinki.

Note. A species typical of the Caucasus, of which a further study is needed, especially a comparison with *K. latifolia* with which it shares a common habitat and is closely related morphologically. Hybridization between these two species is highly probable.

One apparent hybrid is a form intermediate in fruit (4-locular capsules with wings, as in *K. latifolia*) described from near Tbilisi (Saguramo Mountains, etc.) by K. A. Gachechiladze, with an extremely depressed flowering as common in hybrids.

6. *K. macroptera* (Rupr.) Prokh. comb. nova. — *Euonymus macroptera* Rupr. in Bull. Phys.-Mat. Acad. Sc. Petersb. XV (1857) 358; Schmidt, Sakhal. Fl. (1868) 121; Kom., Fl. Man'chzh. II, 711; Krisht., in B. Fedch., Fl. Az. Ross. V, 25; Sugawara, Ill. Fl. Saghalien, 1275. — *E. ussuriensis* Maxim. in Bull. Acad. Sc. Petersb. XXVII (1881) 449. — Ic.: Krisht. l. c. 26, tabl. II; Sugawara, l. c. 1274, tab. 586.

Shrubs, rarely trees, glabrous, with erect stem 4–10(12) cm thick; branches erect, flexible, rounded, with gray or dark brown bark; buds in the fall narrowly fusiform, 10–15 mm long, acuminate, shorter in the spring (from 5 mm), ovoid, sometimes even obtuse; leaves long-cuneate at base, oblong-ovate or broadly elliptic, 3.5–15 cm long, 1.5–8 cm wide, widest in the upper part, obtuse at apex and abruptly mucronate or gradually acuminate, regularly serrate with appressed teeth, scarious, paler beneath, with 4–15 mm long petioles. Cymes on peduncles 2.5–8.5 cm long, substended by lower leaves distinctly shorter or in axils of deciduous scales, composed of (2)5 rays, the median ray reduced, usually simple and monanthous or once bifurcate, the lateral conspicuously longer, once or twice 3-branched, the outer spreading, simple, (2)9–21-flowered; pedicels unequal; bracts and bracteoles deciduous; flowers 4-merous, small, 3–5 mm long; petals oblong-orbicular, greenish-white; stamens with subsessile anthers; stigmas subsessile; capsule 4-lobed, ca. 5 mm long, flat above, convexly cup-shaped, below, 25–27 mm in diameter, wings on lobes 4, suberect, opposite, acuminate, sometimes hamate at apex (10–15 mm long), several times longer than width of cell altogether ca. 25–45 mm in diameter), dark pink; seeds oblong, ca. 6 mm long, entirely enveloped by orange or pink-red aril. Fl. May–June, Fr. August–September.

Shady forests, deciduous and conifer, often grass plots in forests and in valleys, stony slopes and coastal bluffs. — Far East: Uda, Uss., Sakh. (and Kurile Islands). **Gen. distr.:** Jap.-Ch. (Japan, Korea, Manchuria). Described from Kurfi stream higher than [Greater] Kizi Lake of the lower Amur system. Type in Leningrad.

Economic importance. In addition to the ornamental value which it shares with the other spindle-trees, the flexible wood of *K. macroptera* is used in Sakhalin and along the Amur for various purposes.

Tribe 2. EUCELASTREAE Lois. in E. u. P. Pflanzenfam. III, 5 (1892) 203. — For characteristics of the tribe see Key on page 418.

574 Genus 868. **CELASTRUS*** L.

L. Gen. pl. ed. 5 (1754) 91, No. 239.

Flowers cup-shaped-campanulate, unisexual, sometimes dioecious, always 5-merous, in racemiform or paniculate axillary or terminal inflorescences or solitary in axils of cauline leaves, on pedicels with bracteoles; calyx cup-shaped at base, with erect sepals; petals directed upward, oblong-ovate, spreading only at apex; disk saucer-shaped on concave, entire or 5-lobed; stamens situated between notches at edge of disk, in staminate flowers nearly as long as petals, with distinct subulate or ribbonlike filaments, anthers dorsifixed, oblong or ovate, cordate at base, opening inside

* From the Greek celastos - in translation, "hot star" (from celeos - hot and astron - star). This name by Theophrastus referred to the holly *Ilex aquifolium* L. and was included only by Linnaeus in this genus.

by 2 longitudinal slits, stamens in pistillate flowers sterile, with inconspicuous filaments, hardly half as long as petals; ovary loosely sessile on disk of pistillate flower, nearly bottle-shaped, 3-(2-4-)lobed, with 3 (rarely 2 or 4) incomplete cells, tapering to short thickened or slightly elongating trihedral style, separating into 3 in fruit; stigma discoid, 3-partite, with furcate lobes; ovary in staminate flowers abortive, sometimes with separate cells and undeveloped seeds but always sterile; capsule globose or oblong-globular, coriaceous, usually 3-(rarely 2- or 4-) locular, dehiscing loculicidally by 3 valves, with septum at the middle and subulate relics of style above, smooth; seeds usually 2, rarely 1 in each cell, with scarious testa, outside with dissected, fleshy but thin aril open above. Shrubs, usually climbing, unarmed, mostly glabrous; leaves alternate, coriaceous or scarious, serrate or entire, petiolate, with persistent cilialike stipules, sometimes turning into spines.

Economic importance. In India oil is extracted from the seeds of certain species. The bark of another species is of value in medicine in America as an emetic and laxative. Apparently both the species growing in the USSR may in the future be similarly applied.

The genus *Celastrus* occurred in many localities from the Oligocene to the Miocene periods.

Celastrus borealis Heer in Upper Oligocene Sakh. (Due). — *C. cf. elaeana* Ung. (?) in Oligocene L. Don (Kremennaya). — *C. lucida* var. *fossilis* Pim. in Sarmatian Bl. (Amrosievka). — *C. nathorstii* Baik. in Upper Oligocene Sakh. (Cape Sernyi). — *C. persei* Ung. in Sarmatian Bl. (Amrosievka). — *C. taurinensis* Ward. in Upper Cretaceous Ze.-Bu. (Tsagayan).

Celastrophylloides subundulatum Kryshch. in Upper Cretaceous Lena-Kol. (Silyap River).

1. Leaves largely crenate-serrate, with rounded teeth, coriaceous; flowers in umbelliform racemes 2.
- + Leaves dentate, with outwardly recurved bristly teeth, scarious, pale green; stipules conspicuous, hamately spinescent; but dotted scales not spiny; flowers commonly solitary; tall (up to 10 m) climbers 3. *C. flagellaris* Rupr.
2. Leaves yellow-olive, smooth above; stipules not spinescent, ciliate; but outer dotted scales small-spinescent; creeping shrubs, up to 2.5 m high, glabrous 1. *C. orbiculata* Thunb.
- + Leaves rugose-furrowed above, bright green, with furrowed nerves beneath; climbing shrubs 2. *C. strigillosus* Nakai.

1. *C. orbiculata* L. Thunb. Fl. Jap. (1789) p. XLII; Shmidt, Sakhal. Fl. (1868) 122; Kom., Fl. Man'chzh. II, 714; Krisht. in B. Fedch., Fl. Az. Ross. V, 31. — *C. articulata* Thunb. (misprint) l. c. 97. — Ic.: Krisht. l. c. tabl. 13; Kom. and Alis., Oprod. rast. Dal'nevost. kr. 723, tabl. 218, fig. 1.

Creeping and partly climbing shrubs, up to 2.5 m high, glabrous; branches long, interwoven or flexuose, rounded, slightly furrowed, covered with brown bark with glaucous bloom and small corklike lenticels; buds obtusely conoid,

1.5–3 mm long, brown, with subulate scales, the outer forming small erect or outcurved spines; leaves cuneate at base, obovate-elliptic or orbicular-elliptic, sometimes suborbicular, 2–10 cm long, 1.8–7 cm wide, more or less rounded or spatulate-truncate at apex, often with mucro as long as blade, recurved below at margin, largely crenate-serrate except at base, with orbicular teeth, thick, slightly shiny and yellow-olive above, glaucescent and duller beneath, with protruding whitish nerves, the lateral arcuate; stipules fimbriate-ciliate, ca. 1 mm long, brown, deciduous; petioles 5–18 mm long, furrowed. Inflorescence on reduced axillary 1–2 mm long, peduncles, simple, umbelliform-fasciculate, 2–7 (rarely 1-) flowered, with longer unequal pedicels (1–7 mm); terminal inflorescences racemiform, reduced, composed of few subsessile flowers, with bracts under each part of inflorescence, without substending deciduous leaves; bracteoles squamiform, unequal, brown, fimbriate-ciliate at margin; sepals orbicular, whitish at margin, fimbriate; petals greenish; capsules 1–2(5), crowded on 5–8 mm long stipes, subglobose, 4–6 mm in diameter, slightly flattened, the mature bright yellow; seeds compressed-ovate, 3–4 mm long, brown, more or less dotted-pitted, with orange rugose aril. Fl. June (in Sakhalin July), Fr. September.

Bluffs and stony slopes of seacoasts, sandy-clayey deposits among shrubby formations, outside the coastal belt only along winding rivers with riparian woodlands. — Far East: Uss. (seacoast and adjacent islands from Pos'tet Bay through Vladivostok, Shkotovo and Tinkan up to Vladimiro-Aleksandrovskoye; woodland along Suchan River up to Nikolaevka; Ol'ga District); Sakh. (S.). **Gen. distr.:** Jap.-Ch. Described from Japan. Type in Uppsala.

2. *C. strigillosus* Nakai in Tokyo Bot. Mag. XL (1926) 492; Sugawara, III. Fl. Saghalien, 1281. — Ic.: Sugawara, l. c. 1280, tab. 589.

Climbing shrubs, with irregularly furrowed bark and glabrous branches very densely beset with dotlike lenticels; leaves with glabrous, green petioles 15–35 mm long, narrowly furrowed above; leaves acute or tapering-cuneate at base, elliptic or oblong-obovate, 7–14 cm long, 4–8 cm wide, rounded, abruptly mucronate at apex, crenate-serrate, depressedly rugose above, bright green, glabrous, beneath green with protruding grooved nerves. Peduncles axillary, 3–6 mm long, with 1–2 fruits; pedicels 3–5 mm long, glabrous; capsule globose, 6–7 mm long, 3-valvate with persistent styles; seeds with red-orange aril.

Forests. — Far East: Sakh. (S.). **Gen. distr.:** Jap.-Ch. (E.). Described from Honshu Island, from Ninko in former Shimotsuke province. Type in Tokyo.

Note. Not among the collections in the Herbarium of the Botanical Institute. Presented for S. Sakhalin in conformity with Sugawara's report.

3. *C. flagellaris* Rupr. in Bull. Phys.-Math. Acad. Sc. Petersb. XV (1857) 357; Maxim. Prim. 76, 462; Kom., Fl. Man'chzh. II, 716; Krisht. in B. Fedch., Fl. Az. Ross. V, 32. — Ic.: Velen. Vergl. Morph. Pfl. II, 546; Kom. and Alis., Opred. rast. Dal'nevost. kr. 721, tabl. 217, 723, tabl. 218, fig. 2.

Shrubby dioecious climbers, 1–10 m high, rarely creeping, with rooting often underground stems, developing numerous shoots; stems climbing, flexuose, rounded, striate, the juvenile greenish, the older with brown bark; leaves rounded or short-cuneate or truncate-subcordate at base, ovate or elliptic or suborbicular, 4–8 cm long, 1.2–5 cm wide, more or less abruptly cuspidate or rounded at apex, dentate, with outcurved setiform teeth (0.5–1 mm long), scarious, pale green, glabrous or slightly hairy only beneath along nerves; stipules as curved spines, 1.5–2.5 mm long, attached to the bark; petioles long (0.3–4 cm). Flowers axillary, solitary or rarely grouped; pedicels short (4–8 mm long), with scars below middle, from deciduous bracteoles; calyx campanulate, 5-parted, 2–3 mm long, with oblong lobes rounded at apex (ca. 2 mm long); petals spatulate-oblong, 3.5–4 mm long, yellowish-white; stamens usually as long as petals, with filaments up to 4 mm long; styles cylindrical, dilated at base; capsule flattened-globose, 4–5 mm long, 5–6 mm wide, valves with subulate mucro (1–1.5 mm long) above, greenish-yellow; seeds ovate, 3–3.5 mm long, trihedral-tetrahedral, yellow-brown, laterally half-enveloped by rugose reddish-brown aril. Fl. June–July, Fr. August–September.

Margins of taiga and along river valleys, riparian woodland thickets (willow wood, bird-cherry, etc.), also rock crevices and at foot of slopes, easily climbing even up precipitous ravines. — Far East: Ze.-Bu. (southern end of Bureya Mountains 3 km from Ekaterino-nikol'skaya), Uss. (Pos'et Bay, Mongugaya River valley, Suifun River valley, the vicinity of Voroshilov, Vladivostok, Lafu River valley, Maikhe River system near Korolevets, Suchanskii mine). **Gen. distr.:** Jap.-Ch. Described from Bureya Mountains. Type in Leningrad.

Family XCIII. **STAPHYLEACEAE** * DC.

Flowers regular, bisexual, 5-merous, petals free, sepals free or connate only at base; disk flat; stamens 5, inserted at base of disk; ovary of 2–3 more or less connate carpels, 2–3-locular; ovules 2 or many on central placenta of each cell, horizontal or ascending, anatropous; styles free or more or less connate; fruit a capsule with coriaceous (Russian species) or more or less fleshy walls; seeds 1 or few in each cell, with sclerotic testa and large straight embryo embedded in endosperm. Shrubs or trees; leaves usually opposite, imparipinnate, usually stipulate; inflorescences terminal or axillary, paniculate or racemiform.

Small family with 5 genera, 3 distributed in the temperate zone of the northern hemisphere, mainly in E. Asia, and 2 in the tropics of both the Old and New World. The overall number of species is about 25–30.

* Treatment by A. I. Poyarkova.

578 Genus 869. **STAPHYLEA** * L.

L. Sp. pl. ed. 1 (1753) 270. — *Staphylodendron* Scop. Fl. carn. ed. 2, II (1777) 223. — Bumaïda Thunb. Nov. gen. pl. III (1783) 62.

Flowers in elongating drooping compound racemes; sepals and petals white, equal in length; styles connate above; capsule membranous, vesicular-inflated, 2–3-lobed, 2–3-locular, dehiscing apically at the ventral suture, with 1–2, rarely several seeds in each cell. Shrubs or small trees, with opposite imparipinnate leaves of 3–7 leaflets distinctly stipular.

In addition to the Russian species there are about 9 others in the temperate zones of southeast Asia, N. and C. America.

1. Leaves of 3–5 leaflets; capsule lobes distinctly cuneate-tapering at both ends, diverging at summit; seeds 6–7 mm long; flowers 12–15 mm long 1. *S. colchica* Stev.
- + Leaves of 5–7 leaflets; capsule lobes more or less rounded at ends, converging at summit; seeds 10–13 mm long; flowers 7–10 mm long 2. *S. pinnata* L.

Thus far the scanty material on *Staphylea* in the USSR is represented by fruits only.

Staphylea sarmatica Krysht. in *Sarmatian Bl.* (Krynka). — *Staphylea* sp. in *Upper Oligocene Sakh.* (Cape Sernyi).

1. *S. colchica* Stev. in *Bull. Soc. Nat. Mosc.* XXI, 2 (1848) 276; Boiss. *Fl. or.* I, 954; Grossg., *Fl. Kavk.* III, 45. — *lc.*: *Bot. Mag.* t. 7383. — *Exs.*: G. R. F. No. 1712; *Herb. Fl. Cauc.* No. 520; *Pl. or.* exs. No. 392.

Tall shrubs or small trees, with brown bark and glabrous green annotinous shoots; leaves long-petioled, leaves on the short fertile shoots usually ternate, leaves on the long sterile shoots ternate or of 5 leaflets; leaflets oblong-ovate or elliptic, cuneate or rounded-cuneate at base, usually abruptly tapering to mucro at apex, serrulate at margin, at first glabrous or sparsely hairy along midrib, later 7–13 cm long, 4–6.5 cm wide, lateral leaflets usually sessile or rarely very short-petioluled, the median with petiolules 0.8–2.5 cm long. Panicles long-pedunculate, more or less drooping but sometimes suberect, ovate; pedicels with linear bracts at base; sepals as long as petals, 12–13(15) mm long, yellowish-white, sometimes greenish outside, oblong or ovate-oblong; petals oblong; stamens slightly longer than corolla, the filaments glabrous or pubescent (form with pubescent stamens and suberect inflorescence noted as var. *kochiana* Medv. = var. *lasian-dra* Dipp.); capsules 4.5–8 cm long (up to 10 cm long in the cultivated f. *macrocarpa* Zbl.), oblong-obovoid, conically tapering at base, acuminate and diverging at summit; seeds 1–2(3) in each cell, light brown, shiny, pisiform, 6–7 mm long, 5–6 mm in diameter. Fl. May, Fr. from July. (Plate XXXI, Figure 1.)

* From the Greek *staphyle* — bunch and *dendron* — tree: *Staphylodendron*, Pliny's name for *S. pinnata* L.

In the Colchis forests, up to 1,200 m. — Caucasus: W. Transc.
Gen. distr.: Bal.-As. Min. (vicinity of Trebizond). Described from the Colchis. Type in Helsinki.

Economic importance. The floral buds are used for food in their fermented state by the local population. The oil, extracted from the seeds, tastes like pistachio nuts but has purgative properties. A nectariferous and very ornamental plant cultivated by seeds and root suckers.

Note. The most closely related species is the Himalayan *S. emodi* Wall.

2. *S. pinnata* L. Sp. pl. (1753) 270; Ldb. Fl. Ross. I, 496; Boiss. Fl. or. I, 953; Shmal'g., Fl. I, 209; Grossg., Fl. Kavk. III, 45. — *S. pinnatifida* Guld. Reise, I (1787) 421, nom. — Ic.: Rchb. Ic. Fl. Germ. V (1841) tab. 161, f. 4823. — Exs.: Fl. cauc. exs. No. 288.

Shrubs up to 5 m high or small trees, with glabrous green annotinous shoots and yellow-brown branches; leaves with 5, rarely 7, leaflets, long-petioled; leaflets 5–9(11–13) cm long, 3.5–4(5) cm wide, oblong-ovate or elliptic, rounded or cuneate at base, more or less long-acuminate at apex, serrulate, dark green above, pale beneath, subglabrous or sparsely hairy at base, especially when young, lateral leaflets commonly sessile, rarely short-petioluled, median leaflets with 1.5–2 mm long petiolules. Inflorescence a long-pedunculate, oblong, rarely ovate, few-branched panicle; sepals ovate, slightly pinkish outside, 7–10 mm long, 4–6 mm wide; petals white, as long as sepals but narrower; stamens with glabrous or rarely pubescent filaments; capsules 28–55 mm long, broadly obovoid, 2–3-lobed, lobes wide (1.5–2 times longer than wide), more or less rounded at both ends, converging at summit; seeds 1(2) in each cell, 10–13 mm long, 10–11 mm wide, shiny, brown or grayish-brown. Fl. May, Fr. from July. (Plate XXXI, Figure 2.)

Broadleaved forests, forest edges, in the Caucasus in forests of the Colchis type, at elevations of up to ca. 1,300 m. — European part: M. Dnp. (western part), Bes., Bl. (northwest); Caucasus: Cisc. (W.), W. Transc., 580 E. Transc. (Kakhetia–Alazan River). Gen. distr.: Centr. Eur. (southern part); W. Med. (N. and E. Italy), Bal.-As. Min. Described from S. Europe. Type in London.

Economic importance. The same as for *S. colchica* Stev.

Note. A comparative study shows that the European *S. pinnata* has smaller fruit than the Caucasian: the capsules in the European specimens are rarely longer than 30 mm, sometimes reaching 35–37 mm, but usually varying between 25–30 mm. In the Caucasian plants fruits 40–45 mm long are the most frequent. Capsules of 55–60 mm have been observed very rarely as small as 28–35 mm.

There are reports on hybrids between *S. colchica* and *S. pinnata*.

Family XCIV. **ACERACEAE** * LINDL.

Flowers regular, 5- or 4-merous; sepals free or more or less connate; petals sometimes absent; stamens usually 8(4–10); disk annular, usually

* Treatment by A. I. Poyarkova.

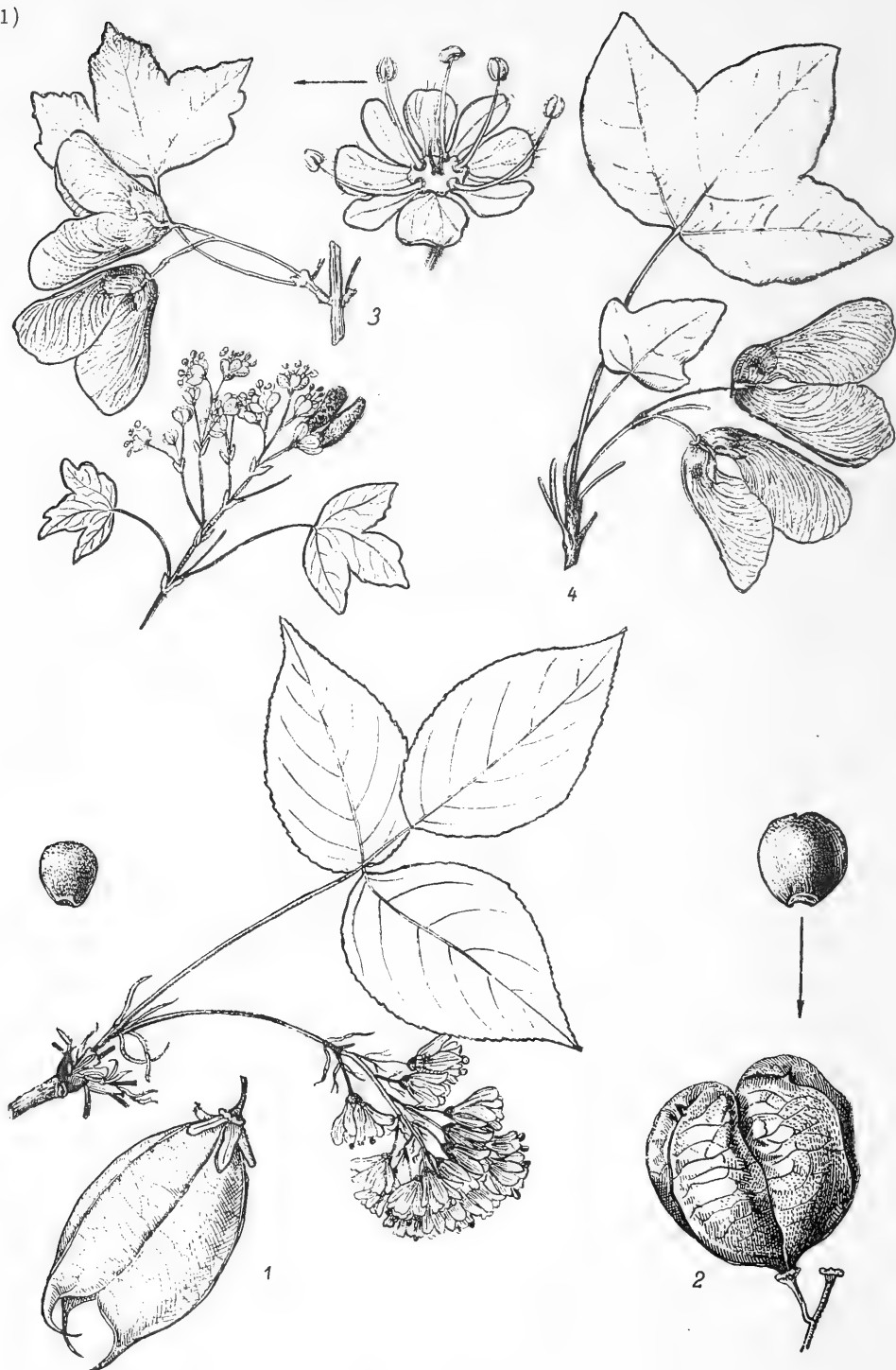


PLATE XXXI. 1 - *Staphylea colchica* Stev.; 2 - *S. pinnata* L.; 3 - *Acer pubescens* Franchet.; 4 - *A. regelii* Pax.

developed, rarely more or less reduced or obsolete; ovary 2-locular, with 2 anatropous ovules in each cell one of which usually developing; fruit 2-winged, separating into 2 mericarps; seeds without endosperm; cotyledons flat or plicate. Trees, rarely shrubs, with entire or pinnately compound leaves.

Two genera, of which one — *Dipteronia* Oliv. — represented by one species in C. China.

The fossils of the section Negundo (sometimes under two different names — Negundo and Rulac) are thus far the only findings. — *Negundo amurensis* Kryshch. in Paleocene Amur (Raichikha).

Rulac quercifolium Hollick in Upper Cretaceous Anadyr (Egnytkun River) and Lena-Kol. (Silyap River).

Genus 870. **ACER** * L.

L. Sp. pl. ed. 1 (1753) 1054

Flowers usually bisexual, the staminate with or without rudimentary ovary, stamens of pistillate flowers absent or with sterile anthers, plants monoecious or dioecious or polygamous; samaras with elongated wing developing from the outer side of cell; inflorescences racemiform or corymbiform at ends of short branches; leaves simple or pinnately compound; leaflets 3–5, mostly lobed, rarely entire with dentate margins.

583 About 150 species distributed in Europe, the Mediterranean area, Caucasus, Southwest and Central Asia, the Himalayas, E. Asia, islands of the Sulu Archipelago, and N. and C. America. Most abundant in the mountainous forest-belt.

Economic importance. All the species of maple are ornamental trees or shrubs notable for the shapes of the leaves and crowns, especially in the fall when the leaves turn yellow, orange, bronze and red. Good nectar plants. Maple wood possesses all the qualities of good timber: density, uniform structure, durability, well-polished, splitting evenly, fine-grained and beautiful color. For these reasons it is widely used in carpentry and woodwork and some species are even used in the building industry. *A. velutinum* and *A. pseudoplatanus* are especially valued for the fine resonant qualities of the timber which is used as sounding boards for musical instruments. They also yield firewood and high-quality charcoal. The sap of the trunk of all species contains sugar, some in such abundant quantity (especially the American species *A. saccharum* Marsh and *A. saccharinum* L.) that in Canada it is made into the popular favorite — maple syrup. The Russian species rich in sugar are *A. platanoides* L., *A. pseudoplatanus* L., *A. trautvetterii* Medv. and *A. tataricum* L. Maple leaves contain properties that yield black, brown and yellow dyes. The leaves are also used to feed cattle.

Acer was widespread in the USSR in Upper Cretaceous deposits (Danian) up to the present; no less than 35 species have been found.

Acer ambiguum Heer in Upper Oligocene Balkh. (Chingistai) and Sakh. Mgach). — *A. amurensis* Pojark. in Paleocene Amur (Kumara, Tsagayan). — *A. arcticum* Heer in Upper Cretaceous Amur (Bureya,

* Name used by Ovid and Pliny, possibly deriving from the Latin *acer* — sharp.

Tsagayan), Anadyr (between Omochei and Telegraficheskii Cape), Oligocene Sakh. (Aleksandrovsk and near Kamennaya).— *A. brachyphyllum* Heer in Sarmatian Bl. (Amvrosievka).— *A. bruckmannii* Heer in Sarmatian Bl. (Amvrosievka).— *A. campestris* L. in postglacial tuffs of Cisc. (Mashuk near Pyatigorsk and Zheleznaya near Zheleznovodsk).— *A. decipiens* A. Br. in Sarmatian Bl. (Orekhov).— *A. grahamense* Kn. et Cock in Oligocene Kamch. (Korf Bay and Krutogorovo).— *A. ibericum* M.B. in Pliocene diatomites of E. Transc. (Bazar-Chai).— *A. insigne* Boiss. et Buhse in Akchagyl E. Trans. (Mal. Kvebebi between Alazan and Kura).— *A. integerrimum* Viv. in Sarmatian Bl. (Krynka).— *A. intergrilobum* O. Web. in Oligocene W. Transc. (Goderzi).— *A. integrum* Bors. in Eocene Sakh. (Lapshinskaya Pad' valley).— *A. laetum* C.A.M. in Sarmatian Bl. (Krynka), in Pliocene diatomites of W. Transc. (Kisatibi).— *A. laetum* var. *pliocenicum* Sap. in Sarmatian Bl. (Amvrosievka) and Miocene Irt. (Irtys River near Tara).— *A. lobelii* Tenore (mutatio?) in Oligocene Balkh. (Chingistai).— *A. obliquum* Pim. in Sarmatian Bl. (Amvrosievka).— *A. osmontii* Kn. in Oligocene (Miocene?) Kamch. (Korf Bay) and Upper Oligocene Sakh. (Cape Sernyi).— *A. palmatum* Thb. mut. *hordenskiöldii* Nath. in Oligocene Balkh. (Chingistai).— cf. *A. paxii* Nath. in Paleocene Kamch. — *A. pictoides* Baik in Upper Oligocene Sakh. (Cape Sernyi).— *A. pictum* Thb. var. *fossile* Nath. in Miocene Uss. (Suifun).— *A. platanoides* L. in 584 interglacial U.V. (Galich, Troitskoe), U. Dnp. (Murava on Berezina, Samostrel'niki, Timoshkovichi, Grodno); in interglacial tuffs of U. Dnp. (Mushkutintsy), Bes. (Darabany); in postglacial tuffs of Cisc. (Mashuk near Pyatigorsk); in post-Pliocene U.V. (Zvenigorod) and V.-Don (Dubenshchina, Gork Region).— *A. platyphyllum* A.Br. in Sarmatian Bl. (Amvrosievka).— *A. polymorphum* S. et Z. var. *miocaenicum* Menz. in Sarmatian Bl. (Amvrosievka).— *A. populifolium* Krassn. (possibly *Hedera eichwaldii* Palib.) in Oligocene V.-Don (Tim).— *A. pseudo-platanus* L. var. *fossilis* in Pliocene W. Transc. (diatomites of Kisatibi).— *A. ribifolium* Göpp. in Sarmatian Bl. (Krynka).— *A. sachalinense* Heer in Oligocene Sakh. (Due).— *A. schmalhauseni* Palib. in Oligocene V.-Don (Tim).— *A. sibiricum* Heer in Upper Cretaceous (Simonova), in Oligocene Balkh. (Ashutas).— *A. sanctae-crucis* Stur. in Sarmatian Bl. (Orekhov).— *A. subcampestre* Göpp. in Sarmatian Bl. (Krynka, Amvrosievka).— *A. tataricum* L. in interglacial U.V. (Troitskoe, Moscow Region).— *A. trilobatum* (Sternb.) A.Br. in Oligocene sandstones of U. Dnp. (Mogil'no, V.-Don (Tim)); in Oligocene Uss. (Amagu), Sakh. (Due, Mgach); in Sarmatian Transcarp. (Uzhgorod, Mukachevo, Berézinka), E. Transc. (Khvtebi, Norno, Martkobi, Patardzeuli, Mtskheta); in Miocene E. Transc. (Garni, Zangi); in Meotian W. Transc. (Guria), in Pliocene diatomites of W. Transc. (Kisatibi); in Miocene Ob (near Tara in Abrosimovka).— *A. turkestanicum* Pax in Pliocene saline deposits of T. Sh. (Kochkorka).— *A. aff. pseudo-platanus* L. in Sarmatian Bl. (Krynka).— *Acer* sp. in Upper Cretaceous Tsagayan Amur (Bureya Tsagayan) samaras; also samaras in Cenomanian Okh. (Khasyn River); Paleocene Uss. (Lake Khanka, Uglovoe area, Amagu River); Paleocene intraconglomerates of Sakh.; Oligocene Sakh. (Fevraleva, Nalu), Oligocene Balkh. (Ashutas).— ? *Acer* sp. in preglacial U.V. (Krushma).

1. Leaves compound of 3-5-leaflets 2.
- + Leaves simple 3.
2. Leaves of 3, more or less equal leaflets with regularly dentate margins; cells of fruits wide, much inflated, trihedral 24. *A. mandschuricum* Maxim.
- + Leaves of 3-5 leaflets, the median distinctly larger than the others; leaflets irregularly dentate at margins and often with some slightly larger and lobate teeth; cells of fruits narrow, flat **A. negundo* L.
3. Leaves usually oblong-ovate, entire or shallowly trifid, biserrate at margin; inflorescence an ovoid panicle; fruit cells slightly inflated, obliquely oval; buds small, with 8-10 bicolored scales 15. *A. tataricum* L.
- + Leaves distinctly 3-5-9-lobed 4.
4. Leaves on fertile branches always 3-lobed, exceptionally 5-lobed, leaves on sterile shoots 5-lobed 5.
- + Leaves 5- and more lobed 13.
5. Leaves up to 17 cm long and wide, orbicular and oblong-tetragonal, with 3 weakly developed narrowly cuspidate lobes, the median wider than the lateral; inflorescence a simple drooping few-flowered raceme 6.
- 585 + Leaves not more than 9 cm long, with well developed lobes; inflorescence corymbiform or paniculate 7.
6. Leaves glabrous beneath, membranous; lobes usually laterally directed 18. *A. tegmentosum* Maxim.
- + Leaves with rufous hairs beneath along nerves; lobes directed forward **A. pennsylvanicum* L.
7. Leaves oblong-ovate, with strongly attenuate large median lobe and much smaller lateral ones at the lower third of blade 8.
- + Leaves orbicular, often wider than long; lobes usually equal 10.
8. Flowers and fruit in simple loose racemes; sometimes some leaves (especially on sterile shoots) wider than the rest and with additional lower lobes 19. *A. komarovii* Pojark.
- + Flowers in many-flowered dense ovoid compound raceme; fruit like a compound one 9.
9. Leaves 3.5-6 cm long, glaucous-green, thick, dull above, often with lobelike large retrorse basal teeth, median lobe with 1, rarely 2 pairs of large teeth; samaras up to 3.5 cm long, with wings more or less directed upward usually dilated above 14. *A. semenovii* Rgl. et Herd.
- + Leaves larger, 5-8.5 cm long, flat, dark green above, shiny; basal teeth and teeth on median lobe absent or obsolete; samaras smaller, up to 3 cm long and with narrower wings ... 13. *A. gianala* Maxim.
10. Leaves entire or irregularly obtusely or acutely toothed at margin, often undulate, frequently 5-lobed, leaves on sterile shoots large-dentate; inflorescence a small pedunculate few-flowered panicle; pedicels 1.5 times longer than flowers; stamens inserted at middle of disk; mericarps flat, coriaceous 11.
- + Leaves entire, rarely with 1(2) pairs of large teeth at apex, on the sterile shoots sometimes 5-lobed; inflorescence a sessile corymb; pedicels 4 times longer than flowers; mericarps markedly inflated, trihedral, woody 12.

11. Leaves on fertile branches 2.2–4 cm long, 3.5–5.5 cm wide, deeply dissected for $\frac{2}{3}$, rarely $\frac{1}{2}$, into 3 lobes (sometimes with a second pair of weakly developed lobes at base), lobes ovate or oval-lanceolate, usually much undulate, irregularly dentate or serrate at margin, usually truncate at base 7. *A. pubescens* Franch.
- + Leaves up to 9–11 cm long and wide, orbicular or elongating in width then broad-truncate at base, dissected down to the middle, rarely deeper, into 3 lobes (sometimes with additional pair of weakly developed lobes at base), lobes ovate or triangular, entire or obscurely crenate at margin, sometimes with 1 pair of large teeth above 8. *A. regelii* Pax.
- 586 12. Leaves up to 7 cm long, 9 cm wide, glabrous or sparingly pubescent beneath; samaras 2.5–3.5(4) cm long 22. *A. ibericum* M.B.
- + Leaves up to 4 cm long, 5.5 cm wide, densely short-hairy beneath; samaras 2–3 cm long 23. *A. turcomanicum* Pojark.
13. Leaves orbicular, palmately 9(7–11)-lobed, with serrate-incised lobes; flowers purple, in pedunculate corymbs; buds carmine-red, with 2 outer scales and fascicle of yellowish hairs at base 17. *A. pseudosieboldianum* Kom.
- + Leaves usually 5-lobed, if 7-lobed then lobes entire with elongated mucro and mericarps flat 14.
14. Leaves small, 1.7–4 cm long, lobes acute entire but usually undulate at margin; samaras glabrous, 2.5–3 cm long, diverging at an obtuse angle, glabrous 6. *A. divergens* C. Koch.
- + Leaves much larger, averagely 5–10 cm in diameter 15.
15. Leaf lobes entire, abruptly tapering at apex to more or less long mucro; inflorescence glabrous 16.
- + Lobes with few large teeth above or uniformly dentate or serrate at margin, or if lobes entire, then gradually acuminate into an obtuse apex and inflorescence spreading-hairy 19.
16. Leaves always short-hairy beneath; flowers large, up to 1 cm in diameter, with white petals; samaras very large, up to 6 cm long, 4.5 cm on average 3. *A. turkestanicum* Pax.
- + Leaves glabrous beneath or the largest hairy along nerves; flowers ca. 8 mm in diameter; petals white or greenish; samaras with vertical wings, diverging at an acute angle 17.
17. Leaves 5–7-lobed, with short wide lobes the lower antrorse; samaras diverging at a very sharp angle, often with parallel wings 1. *A. pictum* Thunb.
- + Leaves with more developed, longer and narrower lobes, sometimes oblong-ovate; samaras diverging at a wide angle, often at right or obtuse angle 18.
- 587 18. Leaves on short branches, averagely about 8 mm [cm] long; flowers small, 5–6[7] mm in diameter; petals greenish-yellow; samaras 1.2–3 cm long, diverging at an obtuse angle 4. *A. laetum* C.A.M.
- + Leaves on short branches, average about 6 cm long; flowers larger [? 6–]8 mm in diameter; petals yellow; samaras 1.8–2.5(3) cm long, diverging at an obtuse or acute angle 2. *A. mono* Maxim.

19. Inflorescence hairy; leaf lobes entire or with 1–2 pairs of large teeth near apex 20.
- + Inflorescence glabrous; leaf lobes with 1–2 pairs of large teeth in upper part or uniformly dentate 21.
20. Flowers in pedunculate branching panicles at summit of leafy branches; pedicels 1.5 times longer than flowers; mericarps flat; leaf-lobes obtuse, rarely acute (but not mucronate), with 1–2 pairs of obtuse teeth at apex or entire 9. *A. campestre* L.
- + Flowers in few-flowered fascicles developing from leafless buds; pedicels 4 times longer than flowers; mericarps much inflated; leaf-lobes with 1–2 pairs of large teeth attenuate like lobes into mucro ★*A. saccharum* Marsh.
21. Leaf lobes with only 1–2 pairs of large teeth 22.
- + Leaf lobes more or less uniformly large-bidentate at margin . . . 24.
22. Leaf lobes acute, their teeth setose with thin mucro at apex; mericarps flat 5. *A. platanoides* L.
- + Leaf lobes and teeth without mucro; fruit 3-locular, mericarps much inflated 23.
23. Leaves usually dissected to the middle, lobes wide, as long as wide or sometimes shorter, usually obtuse at apex 20. *A. hyrcanum* F. et M.
- + Leaves usually deeper, dissected, often for $\frac{2}{3}$; lobes narrower than in the preceding species, generally 1.5–2 times longer than wide, usually acuminate at apex 21. *A. stevenii* Pojark.
24. Samaras small, up to 2–3 cm long; leaf bidentate or biserrate at margin, teeth equal (at least in most leaves) 25.
- + Samaras large, 3.5–5 cm long; leaves largely and irregularly bidentate at margin and usually with 1–2 pairs of prominent lobelike teeth 28.
25. Leaves velutinous-hairy beneath (on sterile shoots sometimes sparingly pubescent); flowers in narrow dense spikelike panicle; samaras 1.8–2.5 cm long, with cells finely netted-veined 16. *A. ukurunduense* Trautv. et Mey.
- + Adult leaves glabrous or pubescent only along nerves; flowers and fruits in simple few-flowered raceme or few-flowered umbels or in fascicles 26.
26. Samara cells ribbed-alveolate; inflorescence 4–6-flowered corymb, the pistillate at summit of leafy branches, the staminate developing from leafless individual buds; leaf blade broad, median lobe much larger than the lateral, subrhombic 25. *A. barbinerve* Maxim.
- + Samara cells finely netted-veined, not alveolate 27.
27. Flowers and fruits yellowish, in simple loose racemes at summit of leafy branches; leaf blade thin, with median lobe much exceeding the lateral and attenuate into a long mucro 19. *A. komarovii* Pojark.
- + Flowers and fruits red, developing from individual leafless buds; median lobe of leaf slightly longer than lateral, all broad, without mucro ★*A. rubrum* L.
28. Flowers and fruits in fascicles, developing from individual leafless buds; leaves biserrate at margin, dark above and light beneath; lobes acuminate ★*A. saccharinum* L.

- + Flowers in many-flowered corymbs or racemiform inflorescences at summit of leafy branches 29
- 29. Leaves very large, up to 30 cm long, lobes usually antrorse, the lower pair usually partly developed; flowers in large ovoid corymbiform many-flowered inflorescences; young mericarps narrowly oblong, sublinear, the adult orbicular 10. *A. velutinum* Boiss
- + Leaves up to 15 cm long; lobes usually spreading; inflorescence a dense spikelike elongated panicle or a loose corymbiform broad panicle; mericarps broad from onset 30
- 30. Leaf lobes usually cuneately tapering at base; leaves yellowish beneath; inflorescence erect, corymbiform, loose; buds dark brown, carmine-red inside 12. *A. trautvetterii* Medw.
- + Leaf lobes usually with parallel margins; leaves whitish and glaucescent beneath; inflorescence a long narrow spikelike dense panicle; buds yellowish-green, yellow inside 11. *A. pseudoplatanus* L

Section 1. PLATANOIDEA Pax. in Engl. Bot. Jahrb. VI (1885) 327; VII (1886) 233. — Leaves simple, 3–7–(9-)lobed; buds with few pairs of scales (usually 6); flowers in terminal corymbiform inflorescences, the
 589 staminate and pseudo-bisexual (possibly truly bisexual) in monoecious plants, developing before, together with or slightly later than leaves; sepals free; stamens 8 or 5, inserted at the middle of a fleshy disk; nuts (cells) of samaras flat. Species of the Old World.

Series 1. *Picta* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 278. — Inflorescence glabrous, many-flowered; stamens 8; samaras with glabrous nuts and wings, spreading or diverging at an acute angle; leaves 5–7-lobed, lobes usually entire (rarely some with 1–2 teeth).

Ten to 12 species distributed in the mountain forests of China, Japan, Himalayas, Caucasus and S. Italy.

1. *A. pictum* Thunb. Fl. Jap. (1784) 162, non in N. Acta Ups. IV (1784) 40; Fr. Schmidt in Mem. Acad. Petersb. VII, ser. XII, 2 (1868) 119; Maxim. in Mel. biol. X (1880) 599; p. p.: var. α . et β . — *A. pictum* var. *eupictum* Pax in Engl. Bot. Jahrb. VII (1886) 236. — *A. lobelii* ssp. *pictum* Wesmael in Bull. Soc. bot. Belg. XXIX, 56. — *A. pictum* var. *typicum* subvar. *eupictum* Pax in Pflanzenr. 8 (IV, 163) (1902) 47; Sugawara, Ill. Fl. Saghal. III, 1283. — Ic.: Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 280, fig. 9.

Tree, up to 20 m high, with sparingly pubescent brown juvenile shoots and brown-gray branches; leaves thin, dark green above, shiny, yellow-green beneath, paler, glabrous except for hair-tufts at angles of nerves at leaf base, 5–12 cm long, 6–10 cm wide, usually broadening, rarely orbicular, wide at base and usually deeply cordate-notched, 5–7–(9-)lobed, lobes always entire, broadly triangular, abruptly tapering to a long mucro, basal leaves generally slightly developed, sometimes reduced to a single mucro. Panicles glabrous; flowers greenish-yellow; sepals oblong-ovate, obtuse, the outer sometimes hairy at base, 6 mm long; petals narrowly oblong-oval,

glabrous; stamens 8, longer than petals, glabrous; ovary pubescent or glabrous; samaras 2.5–3.5 cm long, vertical or diverging at an acute angle, nuts sometimes pubescent outside, wings glabrous, acute or obtuse, sometimes slightly dilated. Fl. May, Fr. August–September.

Forests. — Far East: Sakh. (southern part and S. Kurile Islands).

Gen. distr.: Jap.-Ch. (Japan: Hokkaido, Honsu, Shikoku, Kyushu).

Described from Japan. Type in Uppsala.

Note. This species should definitely be differentiated from *A. mono* Maxim. although there are forms of *A. pictum* from Japan that have more deeply dissected leaves than usual and, accordingly, narrower lobes thus resembling *A. mono*. Besides the fruits, these variable forms differ from *A. mono* by much narrower and longer mucros of leaf lobes.

In 1784, Thunberg described this species twice under the name *Acer pictum* Thunb. (in Fl. Jap. and Nov. Acta Ups. IV). Japanese botanists examining Thunberg's types in the herbarium discovered that in his second description Thunberg had described leaves belonging to the genus *Kalopanax*; consequently, they renamed *Kalopanax ricinifolium* (S. et Z.) Miq. as *K. pictum* Nakai. However, the treatment should have been to rename *Acer pictum* Thunb. as well, which the Japanese did not do. Since *Acer pictum* has been the name for Japanese maple for more than 150 years, it would be more advisable to leave the epithet "*pictum*" than to transfer it to *Kalopanax*.

2. *A. mono* Maxim. in Bull. Acad. Petersb. XV (1857) 126; Kom., Fl. Man'chzh. II, 730; Krisht. in Fl. Az. Ross. V, 48; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II, 726; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 278. — *A. laetum* var. *parviflorum* Rgl. in Bull. Acad. Petersb. XV (1857) 219. — *A. pictum* var. γ . Maxim. in Mel. biol. X (1880) 600. — *A. pictum* var. *mono* Pax in Engl. Bot. Jahrb. VII (1886) 236; Korsh. in Tr. B. S. XII, 318. — *A. lobelii* ssp. *pictum* var. *mono* Wesmael in Bull. Soc. bot. Belg. XXIX (1890) 56. — *A. pictum* var. *typicum* subvar. *mono* Pax in Engl. Pflanzenr. (1902) 47. — Ic.: Nakai, Fl. Sylv. Koreana, I, tab. 12; Poyarkova l. c. fig. 8.

Trees, up to 15 m high, with dense crown and gray bark; juvenile shoots hairy, rarely glabrous, pale, yellowish or gray; leaves 6–11 cm long, 9–12 cm wide, borne on short shoots, thick, shiny beneath even when young, with hairy tufts at angles of nerves at leaf base, nearly always 5-lobed, rarely with 1 additional pair of rudimentary lobes at base, lobes triangular or oval-triangular, attenuate into a long mucro; entire, sometimes slightly undulate at margin; leaves on sterile shoots up to 11–15 cm long, usually deeply cut, often 7-lobed; all leaves truncate or rounded at base, shallowly cordate, rarely subcuneate. Inflorescence 15–30-flowered, glabrous; flowers light yellow, 6–8 mm in diameter; samaras 1.8–3 cm long, diverging at an acute or obtuse angle, wings usually slightly tapering above, 1.5–2.5 times longer than nuts. Fl. May, Fr. August.

Broadleaved forests, edges of conifer and broadleaved forests, mountain slopes, riverbanks, dry stony soil with trees growing individually or in groups. — Far East: Ze.-Bu. (western border along Zeya and Selemdzha rivers), Uda (up to mouth of Amur), Uss., Sakh. (central part of the island).

Gen. distr.: Jap.-Ch. (Manchuria and Korea). Described from the lower reaches of the Amur. Type in Leningrad.

3. *A. turkestanicum* Pax in Engl. Pflanzenr. (1902) 49; O. and B. Fedtsch., Perech. r. Turk. Fl. (1906) 145; Krisht. in Fl. Az. Ross. V, 591 50; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 281. — *A. lobelii* Bge. in Mem. Acad. Petersb. VIII (1861) 231, non Tenore. — *A. lobelii* ssp. *laetum* Pax in Engl. Bot. Jahrb. VII (1886) 237, ex p. — *A. laetum* var. γ . *regelii* Pax in Pflanzenr. IV, 163 (1902) 48. — *A. laetum* B. Fedtsch. l. c. — *A. lipskyi* Rehd. ex Lipskii, Lesn. rast. Turk. (1911) 19. — *A. pseudolaetum* Radde-Fomina in Journ. de la Cycle bot. Acad. Sc. Ukraine, 3-4 (1932) 44. — Ic.: Krisht. l. c. fig. 21, 22, 23; Poyarkova, l. c. fig. 10.

Trees, up to 12 m high, with gray bark and reddish-brown shoots beset when young with very fine glands, branches brownish-gray; leaves 6-9 cm, long, 8-12 cm wide, thick, subcoriaceous, cordate to subtruncate at base, sometimes rounded or cuneate, subglabrous above, short-hairy beneath with hairs longer and denser along nerves, 5- or frequently 7-lobed, partly even 3-lobed (on short shoots), lobes ovate-triangular or triangular, usually short and wide, abruptly tapering to a short mucro, central lobe often bilaterally 1-toothed. Inflorescence 15-30-flowered, glabrous; flowers 10-14 mm in diameter, with purple disk; sepals oval, greenish, obtuse; petals white, ovate, as long as or longer than sepals; samaras very large, 4-5(7) cm long, diverging at an obtuse or nearly a right angle, sometimes spreading, wings up to 1.5 cm wide, dilated above, obtuse. Fl. May-June, Fr. from August.

Mountain slopes and ravines, forming forests. — Centr. Asia: Pam.-Al. and T. Sh. (only Chatkal Range in the west). Gen. distr.: Iran (in the adjacent regions of Afghanistan). Described from the vicinity of Mumynabad. Type was in Berlin? Cotype in Leningrad.

4. *A. laetum* C. A. M. Enum. pl. cauc. (1831) 206; Boiss. Fl. or. I, 949; Shmal'g., Fl. I, 208; Medv., Der. i kust. Kavk. 31. — *A. colchicum* Hartwiss. in Loud. Gard. Magaz. (1840) 632. — *A. lobelii* Ldb. Fl. Ross. I (1842) 456, non Tenore. — *A. hederæfolium* Tournef. ex Rupr. Fl. Cauc. I (1869) 281. — *A. lobelii* ssp. *laetum* var. *colchicum* Pax in Engl. Bot. Jahrb. VII (1886) 237. — *A. laetum* intermedium Kuzn. in Kuzn., in Russk. Geogr. Obshch. XXIII, 3 (1891) 151. — *A. laetum* var. *colchicum* Schwerin in Gartenflora (1893) 459; Pax in Engl. Pflanzenr. (1902) 48. — Ic.: Dippel, Laubholzk. II, f. 217; Poyarkova, l. c. fig. 11.

592 Trees, up to 15 m high, with glabrous, green or more or less red shoots sometimes covered with glaucous bloom; leaves 6-12(17) cm long, 8-14(18) cm wide, thin but dense, glabrous above and beneath or hairy along nerves, bearded at angles of nerves near base, base truncate to more or less deeply cordate, rarely rounded-cuneate, 7-, rarely 5-lobed, lobes ovate, oblong or broadly triangular, rather long-mucronate, the lowermost often rudimentary toothlike, entire at margin, sometimes undulate, central lobe sometimes 2-toothed near apex. Flowers small, greenish, 6-7 mm in diameter, with narrowly oval sepals and slightly wider petals; samaras 2.5-3.8 cm long, diverging at an obtuse or rarely right angle, wings obtuse, often dilating above, 1.5-2 times longer than nuts. Fl. May, Fr. September.

Mountain forests of the relict type, up to 2,000 m, usually as isolated trees.—Caucasus: Cisc., W. Transc., E. Transc. (northeastern part, Lagodekhi gorge and Kuba district), S. Transc. (Kirovakan, Karabakh, Zangezur), Tal. Gen. distr.: Bal.-As. Min. (Pontus Range), Iran. (Elburz). Described from Talysh. Type in Leningrad.

Series 2. *Platanoidea* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I, (1933) 278.—Inflorescence of 15–30 flowers. Leaf lobes largely incised-dentate. Otherwise, like the preceding series. One species is included in this series.

5. *A. platanoides* L. Sp. pl. (1753) 1055; M. B. Fl. taur.-cauc. II, 446; Ldb. Fl. Ross. I, 456; Boiss. Fl. or. I, 948; Shmal'g., Fl. I, 208; Pax in Engl. Pflanzenr. (1902) 49.—*A. crispum* Lauth, De Acere (1781) 23.—*A. pseudoplatanus* Falk in Beitr. topogr. Kenntn. Russisch. Reich, II (1786) 279, non L.—*A. rotundum* Dulac, Fl. Hautes-Pyren. (1867) 241.—Ic.: Rchb. Ic. Fl. Germ. V, tab. 164, f. 4828; Vol'f and Palib., Der. i kust. Ross. 578; Syreishch., Fl. Mosk. gub. II (1907) 347.

Trees, up to 20 m high, sometimes up to 30 m, with dense broad crown and dark brownish-gray to nearly black bark, longitudinally splitting when adult; leaves 5–12(18) cm long, 8–13(22) cm wide, dark green above, slightly paler and shiny beneath, glabrous or hairy along nerves beneath and bearded at an their angles, orbicular, broadly cordate at base, rarely truncate or broadly cuneate and if so only on short shoots, usually 5-lobed, rarely 3-, or 7-lobed, 3 upper lobes subequal, the lower much smaller, all largely incised-dentate, teeth and apices thin-mucronate. Flowers large, greenish-yellow, opening before leaves; sepals obovate, obtuse; petals slightly narrower than and nearly as long as sepals, tapering to claw; samaras up to 4 cm long, with wings diverging at an obtuse angle or spreading. Fl. May, Fr. September.

Broadleaved and commonly mixed forests, rarely in large numbers, up to the subalpine belt in the Caucasian Mountains.—European part: Dv.-Pech. 593 (southern part), Lad.-Ilm., U. V., V.-Kama, U. Dnp., M. Dnp., V. Don, Transv., Bes., Bl. (only most northeastern part), L. Don (northern part); Caucasus: all regions. Gen. distr.: Scand. (southern part), Centr. Eur., Atl. Eur. (southernmost part), Med. (northern part), Bal.-As. Min. (Balkans). Described from Europe. Type in London.

Series 3. *Quinqueloba* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 278.—Inflorescence few-flowered; leaf lobes entire, acute or gradually acuminate or partly obtuse; stamens 8. One species.

6. *A. divergens* C. Koch et Pax in Engl. Bot. Jahrb. VII (1886) 234; Lipsk. in Tr. Tifl. Bot. Sada, IV (1895) 267.—*A. quinquelobum* C. Koch, Deutsch. Dendrol. I (1869) 540, non Gilib. nec Saporta; Pax in Engl. Pflanzr. VIII (IV, 163) (1902) 53; C. K. Schn. Handb. Laubholz. II (1907) 223; Medved., Der. i kust. Kavk. 33; Grossg., Fl. Kavk. III, 47; Poyarkova in Trud. Bot. Inst. AN SSSR, ser. 1, I, 296.—*A. lasicum* Schwer. in Gartenfl. (1898) 123.—Ic.: Schwer. l. c. tab. 32, 33; Poyarkova, l. c. fig. 13.

Small trees, xeromorphic in habit, with gray bark and thin brownish shoots; buds small, the apical up to 4 mm long, the lateral up to 2.5 mm, usually with 6 outer glabrous red-brown scales; leaves coriaceous, dark green above, much lighter beneath, with nerves sharply protruding bilaterally, shiny, glabrous, 1.5–4.5 cm long, 1.7–6 cm wide, usually truncate at base, 5- and partly 3-lobed, the lobes broadly triangular or oblong-triangular, always entire, often undulate at margin, the 3 upper lobes subequal, the lower ones usually slightly developed; leaves on long sterile shoots often smaller than on the short ones (from 0.9 cm long and 1.1 cm wide), deeply cordate at base, usually 5-lobed, the lower well developed, the upper frequently obtuse, unequal. Inflorescence glabrous, few-flowered; staminate flowers greenish-yellow, small; sepals oblong-oval, obtuse, 5.5 mm long, 1.5 mm wide, sparsely long-hairy at margin; petals obovate, long-clawed, notched at apex, glabrous, 3 mm long, 1.5 mm wide; stamens 8, as long as sepals; rudimentary ovary very small; pistillate flowers unknown; samaras 2.5–3 cm long, diverging at a very obtuse angle, sometimes at 180°, wings stiff, thick, usually tapering at both ends. Fr. in August.

Dry slopes with woody-shrubby vegetation. Thus far unknown in the USSR. Gen. distr.: Arm.-Kurd. (Chorokh River, former Artvin, Olty districts). Described from the Chorokh River valley. Type in Berlin.

Note. The taxonomic position of this species is in need of precise determination. It should be noted that many characters (structure of the 594 buds, leaves of the short and especially the long shoots varying in shape of blade, and the few-flowered inflorescences) are clear evidence of the relationship of *A. divergens* with many species of the series *Pubescentia* of which it has also similar ecology.

Series 4. *Pubescentia* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 307. — Flowers in few-flowered glabrous panicles, small; sepals sparsely long-hairy; petals glabrous; stamens usually 5; samaras diverging at an acute angle, with glabrous or pubescent nuts; leaves on short shoots usually 3-, rarely 5-lobed, lobes dentate or entire; plants without milky juice.

In addition to the Central Asian species the following should be included in this series: *A. pilosum* Maxim. — from C. China (Kansu), *A. pentapomicum* Sew. — from the Himalayas (Simla), and *A. isolobum* Kurz. — from Lower Burma (Indochina).

7. *A. pubescens* Franch. in Ann. sc. nat. 6, ser. XV (1833) 246; Pax in Engl. Bot. Jahrb. VII, 228; Nevskii in Tr. Bot. Inst. AN SSSR, ser. 1, IV (1937). — *A. monspessulanum* var. *pubescens* Wesmael in Bull. soc. bot. Belg. XXIX (1890) 50. — *A. pubescens* α . *genuinum* Pax in Pflanzr. 8 (IV, 163) (1902) 60; Fedch., Perech. r. Turk. II, 145. — *A. monspessulanum* var. *crenatum* Rgl. ex Komar. in Tr. SPb. obshch. est. XXVII (1896) 157. — *A. fedtschenkoanum* Kryshch. in Fl. Az. Ross. 5 (1914) 57, p. p.; Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 309. — Ic.: Pojarkova, l. c. fig. 15, $A_1 - A_5$; fig. 17.

Small trees, with light gray bark, the juvenile branches glabrous, brown, the adult gray; leaves thick, glaucous, paler beneath, bilaterally short-hairy, more densely so beneath, sometimes glabrous above, wide, leaves on the

short branches 2.2–4 cm long, 3.5–5.5 cm wide, on the sterile up to 5 cm long, 6(7) cm wide, usually 3-, rarely 5-lobed with weakly developed lower lobes; blades usually deeply dissected for $\frac{2}{3}$, rarely down to the middle, usually truncate, rarely cordate (mainly on sterile shoots), mostly wide and rarely narrow at base; lobes ovate to oval-lanceolate, long- or short-acuminate then obtuse at tip, usually strongly undulate at margin, irregularly shallowly or obtusely dentate or serrate, sometimes with 1–2 prominent teeth in upper part. Inflorescence a small pedunculate glabrous 5–10-flowered panicle; flowers greenish-yellow, small; sepals 4–4.5 cm long, broadly ovate, sparsely long hairy at margin; petals obovate, glabrous, narrower and slightly longer than sepals; stamens slightly longer than petals, glabrous; ovary glabrous; samaras 2.5–3.5 cm long, diverging at a right or obtuse angle, cells [nuts] covered with veins, wings rather narrow with nearly parallel margins to strongly dilated above. Fl. May, Fr. September. (Plate XXXI, Figure 3.)

Slopes of mountains and ravines, in woody-shrubby and Central Asian juniper woodland belt. — Centr. Asia: Pam.-Al. Endemic. Described from Baisun Mountains in SW Uzbekistan. Type in Paris.

Note. The distribution of *A. pubescens* is limited to the western, more arid mountain regions of Pamir-Alai which are characterized by the absence of nut trees and largely also of *A. turkestanicum*. It occurs in the mountains of Kugitang, Baisun and Guzar, in Baba-Tag, Darai-Nikhan, Gazi-Mailik, in the Zeravshan area on the northern slope of Gissar Range and S. Turkestan (not, apparently, eastward of the Fon River) and in the Mal'guzar Mountains. This species is not always much different from *A. regelii*, to which it is very closely related, but when distinguished, the distinction is very obvious even though the differences are in size, shape and dentation of leaves. The geographical limits are also very clear: *A. pubescens* does not extend beyond the eastern "nut" areas of Gissar Range whose eastern border is apparently the Fon River and Gazi-Mailik Range, and conversely *A. regelii* hardly reaches the "nutless" areas, coming into contact with *A. pubescens* only at the basin of the Zeravshan River (northern slope of Gissar), in Gazi-Mailik Range and in the northern junction of Darai-Nikhan.

8. *A. regelii* Pax in Pflanz. 8 (IV, 163) (1902) 60; B. Fedch., Perech. r. Turk. II (1909) 145; Krisht. in Fl. Az. Ross. V (1914) 54; Poyark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 311. —? *A. monspessulanum* var. *turkestanicum* Franch. in Ann. sc. nat. 6 ser. XV (1883) 247. — *A. pubescens* Krysht. l. c. p. 55, non Franch.; Poyark. l. c. 307. — *A. fedschenkoanum* Krysht. l. c. p. 57, p. p. — Ic.: Pax in Pflanz. (1902) f. 10; Poyarkova, l. c. fig. 15, B₁–B₄ and C₁–C₂, fig. 16.

Trees, 6–18 m high, with light gray bark, juvenile branches brown, later gray; leaves thick, glaucous, darker above, sparingly hairy, rarely glabrous, densely very short-hairy beneath, orbicular, rounded or cuneate at the usually entire base or if leaves angustate then broad truncate often cordate at base, much larger than in *A. pubescens*, up to 9–11 cm long and wide, 5–6 cm × 6–8 cm, leaves on short fertile branches usually 3-, rarely 5-lobed, with slightly developed lower lobes, blades (usually those on short branches)

markedly variable in degree of division and shape of lobes, cut down to the middle or somewhat less, rarely deeper; lobes ovate or triangular, usually wide, acute, rarely oblong-triangular, acuminate, entire or obscurely acutely or obtusely crenate at margin, sometimes the median with 1 pair of large prominent teeth above; leaves on sterile shoots usually more
596 deeply cut, often 5-lobed, distinctly dentate at margins. Flowers in few-flowered panicles, greenish-yellow; sepals ovate and oblong-ovate, sparsely long hairy at margin; petals oblong-obovate, tapering to long claw, glabrous; stamens glabrous, slightly longer than perianth; ovary glabrous or pubescent; samaras 2.8–5 cm long, with wings vertical or diverging at an acute or right angle, nuts usually much dilated above, glabrous or pubescent. Fr. May, Fr. September. (Plate XXXI, Figure 4.)

Central mountain belt of woods and shrubs, mountain and ravine slopes, mainly in xerophytic variants of woody vegetation. — Centr. Asia: Pam.-Al. (Gissar Range, from its southern slope through the Tadzhi Mountains from Baba-Tag to the east, and from the Gissar northern slope to the west of Fan-Darya, and on Darvaz Range). Gen. distr.: Iran. (Afghanistan). Described from Kshtut. Type in Berlin, cotype in Leningrad.

Note. Krishtofovich added to the two preceding species still another one — *A. fedtschenkoanum* Krysh.; a study of herbarium material and observations in nature show that there are only two species in Pamir-Alai whose differences have been detailed in the Key and in the preceding Note. Specimens belonging to *A. regelii* and *A. pubescens* from the Zeravshan River basin were united to become *A. fedtschenkoanum*. The drawing presented by Kristofovich is that of *A. regelii*.

Series 5. *Campestris* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 297. — Inflorescences many-flowered, covered with long hairs; stamens 8; samaras with spreading wings; leaves 5-, rarely 3-lobed, lobes with pair of large teeth above, rarely entire.

In addition to *A. campestre* L., *A. miyabei* Maxim. from Japan is included in this series.

9. *A. campestre* L. Sp. pl. (1753) 1055; M. B. Fl. taur.-cauc. II, 446; Ldb. Fl. Ross. I, 454; Boiss. Fl. or. I, 948; Shmal'g., Fl. I, 208; Pax in Pflanzenr. 8 (IV, 163) 55; Grossg., Fl. Kavk. III, 46. — *A. trilobum* Gilib. Fl. lithuan. II (1782) 327. — *A. austriacum* Tratt. Observ. bot. fasc. I (1811) 5. — Ic.: Rchb. Ic. Fl. Germ. V, tab. 162; Fedch. and Fler., Fl. Evr. Ross. 622; Maevsk., Fl. Sr. Ross. 622; Maevsk., Fl. Sr. Ross. (1940) 209. — Exs.: G. R. F. No. 1060; Callier, It. taur. No. 568.

Trees, up to 15 m high, with broad crown and brownish-gray bark longitudinally splitting; juvenile shoots yellowish-brown, glabrous or pubescent, sometimes winged because of corklike projections (*A. suberosum* Dumort.); leaves soft, rarely thick, dark green above, paler, yellow-green beneath, pubescent or only with tufts of hairs at axils of nerves, cordate at base, strongly variable in shape, usually 5-lobed with 3 upper lobes bearing
597 a very large lobate tooth above (var. *lobatum* Pax and var. *normale* Schwer.), rarely lobes entire (var. *austriacum* DC. = *A. austriacum* Tratt. and var. *acutilobum* Pax. = *A. oxytomum* Borb.), some individuals with 3-lobed leaves then lobes broad (var. *marsicum* C. Koch = *A. marsicum* Guss.) or narrower and longer (var. *pseudomarsicum* Pax); lobes usually tapering to a short or long blunt point;

petioles slightly longer or shorter than blades, glabrous or pubescent. Rhachis of inflorescence and pedicels spreading-hairy; flowers developing somewhat later than leaves, yellowish-green; sepals oblong-oval, hairy outside and along margins; petals narrower, spatulate, hairy at margin; filaments glabrous; ovary glabrous; ovary glabrous or pubescent; samaras 2–3.5 cm long, with spreading wings, straight or curved above or below, sometimes falcately bent; nuts glabrous (ssp. *leiocarpum* Pax = *A. leiocarpum* Opiz) or pubescent (ssp. *hebecarpum* DC. = *A. villicarpum* Lang, *A. eriocarpum* Opiz, *A. lasiocarpum* Wimm. et Grab.). Fr. April–May, depending on the area, Fr. September.

Broadleaved forests at the middle of the European part of the USSR, steppe and valley forests in its southern part, and hemixerophytic forests of the Caucasus. — European part: U. V., M. Dnp., V.-Don, Bes., Bl., Crim., L. Don; Caucasus: all regions. **Gen. distr.:** Scand. (southern-most part), Centr. Eur., Atl. Eur., W. Med., Bal.-As. Min., Arm.-Kurd., Iran. (Elburz). Described from Europe. Type in London.

Economic importance. A honey plant whose wood is used for small articles, also an ornamental grown in steppes.

Section 2. *GEMMATA* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 312. — Buds large, with 5–7 pairs of external scales; leaves large, 5-lobed; flowers staminate and bisexual (plants monoecious), 5-merous, in racemiform or paniculate-corymbiform inflorescences; sepals free; stamens 8, inserted at inner margin of disk; samaras large, with inflated (cells) nuts.

Series 1. *Velutina* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 312. — Inflorescence hairy, a large many-flowered broad pyramidal panicle. Included here is also *A. caesium* Wall. (Himalayas and C. China).

10. *A. velutinum* Boiss. Diagn. I, ser. VI (1845) 28; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 312. — *A. pseudoplatanus* C. A. M. Enum. pl. cauc. casp. (1831) 206; Hohenack. Enum. pl. Talysh. 155. — *A. australis* Kotschy, nom. in herb. exs. No. 893. — *A. insigne* 598 Boiss. et Buhse in Nouv. Met. Soc. Nat. Mosc. XII (1860) 46; Boiss. Fl. or. I, 947; Pax in Engl. Bot. Jahrb. VII (1886) 194, ex. p.; idem in Engl. Pflanzenr. 8, IV, 163 (1902) 15; C. K. Schn. Handbb. d. Laubhk. II (1907) 203; Medved., Der. i kust. Kavk. 39; Grossg., Fl. Kavk. III, 48. — *A. van volxemii* Mast. in Gard. Ghron. (1872) 72. — Ic.: Gard. Chron. (1877) f. 10 et (1891) f. 1–2; Dippel, Laubholz. II (1892) f. 203; Poyarkova, l. c. fig. 18. — Exs.: Herb. Fl. Cauc. No. 429.

Tall trees, with even trunk and broad crown, up to 40 m high, 1.2 m in diameter; bark gray, juvenile shoots reddish-brown, glabrous; leaves up to 30 cm long and wide, averagely 13–15 cm, dark green above, always glabrous, paler beneath, glaucescent or sometimes reddish (var. *wolfii* Schwer.), glabrous (var. *glabrescens* Boiss. et Buhse, var. *van volxemii* (Mast.) Pax) or completely velutinous-hairy beneath (var. *velutinum* Boiss. et Buhse), usually cordate, rarely more or less rounded or truncate at base, always 5-lobed, the three upper lobes ovate, acute, of which the terminal distinctly wider and slightly longer than the lateral, lateral lobes usually antrorse, lower lobes slightly developed, often spreading,

sometimes upper lobes short, obtuse (var. *obtusiloba* Freyn. et Sint.) or, conversely, long-acuminate (var. *longifolia* Bornm.); petioles as long as blade or slightly longer. Panicles long-pedunculate, erect, dense, up to 15 cm long, with hairy axes and pedicels and small hairy bracts; flowers small, greenish-yellow; sepals oblong-ovate; petals narrow, slightly longer; sepals and petals hairy inside; stamens with glabrous filaments, much longer than corolla; fruiting panicle pendulous, with up to 60 samaras; young samaras up to 5 cm long, with narrow oblong hairy nuts, ripe samaras inflated, pisiform, glabrous or sparingly pubescent outside, lined with long hairs inside; wings tapering at base, dilated and rounded above, diverging at close to a right angle, rarely subvertical. Fl. April–May, Fr. from August.

Damp Tertiary relict forests, usually as sparse trees, rarely in small groups, growing up to 1,700 m above sea level. — Caucasus: E. Transc. (forests near Nukha, Kuba and Lagodekhi gorge in Kakhetia), Tal. Gen. distr.: Iran. (Gilan, Mazenderan and Astrabad [former] provinces). Described from N. Iran. Type in Geneva.

Series 2. *Pseudoplatani* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 312. — Inflorescence a dense narrow cylindrical pubescent raceme. Only one species is included here.

11. *A. pseudoplatanus* L. Sp. pl. (1753) 1054; M.B. Fl. taur.-cauc. II (1808) 446; Ldb. Fl. Ross. I, 454; Shmal'g., Fl. I, 207; Pax in Engl. 599 Pflanzennr. (1902) 17; Medv., Der. i kust. Kavk. 37; Grossg., Fl. Kavk. III, 48; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) *A. quinquelobum* Gilib. Fl. lithuan. II (1782) 198. — *A. villosum* Presl, Delic. Prag. (1822) 31. — *A. dittrichii* Ortmann in Opiz, Nomencl. bot. (1831) 42. — *A. laciniatum* Loud. Arb. brit. I (1838) 414. — *A. longifolium* Loud. l. c. —? *A. abchasicum* Rupr. in Mem. Acad. St. Petersb. 7, ser. XV (1870) 277. — *A. villosum* Borbas in Termesz. füz. XIV (1891) 71. — *A. subobtusum* Simenk. in Novenyt. Közlem. VII (1908) 150. — Ic.: Rechb. Ic. Fl. Germ. V (1842) tab. 164, f. 4829; Vol'f and Palib., Opred. der. i kust. (1904) figure on p. 585–586; Hegi, Ill. Fl. V, f. 1843, 1849; Poyarkova, l. c. fig. 19.

Tall, elegant trees with dense pyramidal-globular crown, up to 40 cm high, 1.5 m in diameter; bark brownish-gray, in adult trees splitting and peeling, revealing young pale bark thus trunk appearing whitish or light gray; young shoots glabrous, brownish-gray; outer bud scales yellow-green, the inner densely pubescent, yellowish, large; leaves large, up to 17 cm long and wide, orbicular-cordate, dark green, dull above, glaucescent or whitish beneath, sometimes dirty-red (f. *purpurascens* Pax), juvenile leaves rather densely pubescent especially beneath along nerves, the adult only with basal tufts at angles of nerves, some forms with leaves uninterruptedly hairy beneath (var. *villosum* Parl.); blades usually 5-lobed, dissected for $\frac{1}{3}$ to $\frac{1}{2}$, rarely deeper; upper lateral lobes nearly as long as the median, obliquely antrorse and then usually diverging outwardly, notches between them acute, lower lobes small, sometimes obsolete (f. *subtrilobum* Schwer.) or abortive, all lobes ovate or ovate-triangular,

short- or rarely long-acuminate, largely and obtusely dentate at margin, partly bidentate, median lobe sometimes with a large lobate tooth at both upper sides; petioles about as long as blade. Inflorescence a long-pedunculate narrow raceme, sometimes compound below, many-flowered, up to 16 cm long, with hairy axes and pedicels, pedicels twice as long as flowers; bracts small, deciduous; flowers up to 8 mm in diameter, yellowish-green, with oblong obtuse subequal sepals and petals, pubescent inside, long-ciliate at margin; samaras up to 6 cm long, the ripe brown, with orbicular inflated nuts, the young rather densely hairy, the mature glabrous or sparingly hairy, wings tapering at base, rounded above, mostly diverging at a very acute angle (vertical with parallel outside margins), rarely at an obtuse angle. Fl. May-June, Fr. September.

Trees mainly in mountainous forests, rarely descending to plains in the European part. Growing in different soils but preferably calcareous soil; achieving good growth in deep, moderately moist soils; occurring in stony localities, taluses, rock crevices, banks of rivers and streams. Commonly occurring individually, rarely in small stands. In the Caucasus the trees grow in forests of the lower and middle belts up to 1,200-1,500 m. — European part: U.Dns., M.Dnp., Bes.; Caucasus: Cisc., W. Transc. Gen. distr.: Centr.Eur., Atl.Eur. (SW and SE, Spain, N.Portugal), Med. (nearly all of southern Europe), Bal.-As.Min. (Balkan Peninsula from the south to Thessaly and Epirus and N. coast of Asia Minor). Described from Europe. Type in London.

Economic importance. Among the more than 50 varieties cultivated in gardens and parks worthy of notice are f. *pyramidale* Nich. with pyramidal crowns, f. *erythrocarpum* Cass. with its red samaras, and the yellowish and white variegated forms f. *aureo-variegatum* Schwer., f. *albo-variegatum* Kirchn., f. *leopoldii* Lem., and f. *argenteum* Schwer. Of interest are f. *worlei* (Ohlendorf) Schwer. with its dark orange leaves that turn a golden yellow, f. *crispum* Schwer. with its undulate leaves, and f. *ternatum* Schwer. with its leaves 3-partite nearly to the base, as well as others.

Series 3. *Trautvetteriana* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 312. — Inflorescence a corymbiform glabrous panicle. In addition to the Russian species this series includes *A. heldreichii* Orph., the high mountain Balkan species.

12. *A. trautvetteri* Medw. in Izv. Kavk. obshch. lyub. est. II (1880) 8; Kuznets. in Zap. Russk. Geogr. Obshch. XXIII, 151; Pax in Engl. Pflanzenr. (1902) 15; C. K. Schn. Handb. Laubholz. II, 204; Medved., Der. i kust. Kavk. 38; Grossg., Fl. Kavk. 47; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 6697; Vol'f and Palib., Opred. der. i kust. ris. on p. 587-589; Poyarkova l. c. fig. 20. — Exs.: G.R.F. No. 107; Pl. or. exs. No. 189; Herb. Fl. Cauc. No. 230b et No. 430.

Trees of average size with broad crown and straight trunk covered with smooth gray bark, but often growing as a knotty sapling or even shrub; juvenile shoots glabrous, brown or reddish-brown; outer bud-scales glabrous, brown, the inner large, carmine-red; leaves 9-14 cm long, 11-16 cm

wide, dark green above, glabrous, pale, yellowish beneath, the juvenile hairy, later with tufts of rufous or rust-colored hairs only at angles of nerves at base of leaves, cordate at base, sometimes base of leaves on short shoots rounded; dissected for $(\frac{1}{2})^{\frac{3}{5}} - \frac{2}{3}$ into 5 lobes; lobes acuminate, the lateral nearly as long as the terminal, usually declinate outwardly above, the lower small, horizontal or recurved below, irregularly acutely dentate at margin, median lobe (often the lateral as well) nearly always with 2 pairs of large teeth above, lower teeth much larger than the upper, lobes widest at level of teeth, cuneately tapering to base. Inflorescence a long-pedunculate small corymbiform panicle; rhachis and pedicels glabrous except for base beset with bundles of rufous hairs; bracts up to 1.8 cm long, not deciduous; flowers ca. 1 cm in diameter, whitish-green; sepals broadly oval; petals nearly as long as sepals, narrower, both hairy at base inside, slightly ciliate at margin; stamens with glabrous filaments; samaras large, 3.5–7 cm long, with vertical wings often partly overlapping each other or slightly diverging, reddish when young, rarely bright carmine-red (f. *erythrocarpa* Dieck), ripe nuts brown, broadly ovoid, inflated, hairy when young, usually glabrous when ripe with internal walls lined with hairs. Fl. June, Fr. September.

Subalpine zone up to 1,800–2,500 m, more often in community with birch, *Sorbus* L. and high mountain shrubs; sometimes in the upper belt of spruce-fir forests, near forest edges, extending beyond the area of forest vegetation; occurs individually or colonial. — Caucasus: Cisc., W., E. and S. Transc., Dag. Described from the Caucasus. Type in Tbilisi?

Economic importance. A cold-resistant, ornamental plant grown very often in parks.

Section 3. *TRILOBATA* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 324. — Buds sessile, small, not more than 3 mm, with 8–10 outer bicolored scales; leaves 3-lobed or entire; flowers 5-merous, in corymbiform panicles; sepals free; petals developed; stamens 8, inserted at inner margin of disk; samaras 2.5–3 cm long, with obliquely oval, slightly inflated (cells) nuts.

Series 1. *Tatarica* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 324. — Leaves membranous, entire or 3-lobed, with large median lobe and small basal lateral ones; petals ovate-oblong, nearly as long as sepals or slightly longer, entire. Five species: 1 in Europe and Caucasus, 1 in Central Asia, 1 in the Far East, 1 in Japan, and 1 in C. China.

13. *A. ginnala* Maxim. in Bull. Acad. Petersb. (1856) 126; Kom., Fl. Man'chzh. II, 719; Koidz. in Journ. Coll. sc. Un-ty Tokyo, XXXII, 1, 30; Krisht. in Fl. Az. Ross. 5 (1914) 39; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II (1932) 725; Poyarkova in Trud. Bot. Inst. AN SSSR, ser. 1, I, 325. — *A. tataricum* var. *laciniatum* Rgl. in Bull. Acad. Petersb. XV (1856) 217. — *A. tataricum* var. *cinnala* Maxim. Prim. Fl. Amur. (1859) 67. — *A. tataricum* Radde, Reisen im süd.-ost. Sibir. (1861) 565, 606, 633, non L. — *A. tataricum* ssp. *ginnala* var.

ginnala Wesmael in Bull. Soc. bot. Belg. XXIX (1890) 31.— *A. ginnala* ssp. *euginnala* Pax in Engl. Bot. Jahrb. VII (1886) 185 ex p.; idem in Engl. Pflanzenr. (1902) 12, ex p.— Ic.: Nakai, Fl. Sylv. Koreana, I (1913) tab. II; Krisht. l. c. fig. 15–16; Poyarkova, l. c. fig. 21.— Exs.: G. R. F. No. 408.

Small trees or tall shrubs, usually ca. 2 m high, rarely up to 6 m, with gray smooth or slightly longitudinally rugose bark; juvenile shoots glabrous, glaucous-green or reddish, later becoming brown; bud-scales reddish at base, black at margin and apex; leaves shiny, dark green above, somewhat paler beneath, often hairy along nerves when young, later glabrous, oval or oblong-oval, 3–8 cm long, rounded or slightly cordate at base, sometimes cuneate; leaves on sterile shoots up to 14 cm long, 3-lobed, with large median lobe, usually tapering at base and long-acuminate at apex, lateral lobes horizontal or slightly antrorse, ovate, acute or acuminate, developed at the lower third of blade, irregularly and acutely toothed at margin, partly bidentate; lower leaves on fertile shoots usually entire, on long sterile shoots more or less strongly dissected; petioles shorter than blades. Inflorescence a dense oval-corymbiform panicle with 20–60 flowers, rhachis and pedicels beset with short-stalked glands; flowers ca. 6 mm in diameter, yellowish; samaras 2.2–3 cm long, green or bright pink, with wings diverging at a very acute angle. Fl. June, Fr. September.

Growing in thickets or individual groups along banks of rivers and streams on sandy-stony soil. Also extending to mountain valleys where occurring only in exposed localities, but not in shrubby formations on slopes or forests.— Far East: Ze.-Bu. (in the west up to Zeya River and Selemdzha Uda. Uss., (often in the basin of the upper reaches of Ussuri and rarely in the Maritime Territory). Gen. distr.: Mongolia (only one locality in Muni-Ula Range in the southeast), Jap.-Ch. (Manchuria, Korea and N. China). Described from Amur. Type in Leningrad.

Economic importance. A handsome ornamental plant grown in parks and gardens. The Chinese extract a black dye from the leaves which is called "sintsa."

14. *A. semenovii* Rgl. et Herd. in Bull. Soc. Nat. Mosc. XXXIX, 1 (1866) 550; O. and B. Fedch., Perech. r. Turk. 1–2, 145; Krisht. in Fl. Az. Ross. 38; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 328.— *A. tataricum* var. *semenovii* Rgl. in Bull. Soc. Nat. Mosc. 603 L, III, 1 (1878) 174, 199, 204, 205; Nichols. in Gard. Chron. (1881) 1, p. 74.— *A. tataricum* ssp. *semenovii* Pax in Engl. Bot. Jahrb. VII (1886) 185; Gams in Hegi, Ill. Fl. V, 274.— *A. tataricum* ssp. *ginnala* var. *semenovii* Wesmael in Bull. Soc. bot. Belg. XXIX (1890) 31.— *A. ginnala* ssp. *semenovii* Pax in Engl. Pflanzenr. (1902) 12; C. K. Schneid. Handb. Laubholz. II, 196.— Ic.: Rgl. et Herd. l. c. tab. XII, f. 3, 4; Poyarkova l. c. fig. 22.

Shrubs or small trees with gray longitudinally rugose bark and glabrous brown annotinous shoots; leaves thin but dense, dull, glaucous-green, pale beneath, 1.2–4.5 cm long, 1–3.2 cm wide, ovate, nearly always rounded at base, leaves on sterile shoots cordate or rarely truncate, upper leaves on fertile shoots 3-lobed, with large median lobe and much smaller obliquely antrorse, rarely horizontal lateral lobes, lower leaves often entire; lobes

ovate, gradually acuminate, the median with pair of large lobate teeth above, margins simple to often bidentate, teeth obtuse, rarely acute; leaves on sterile shoots up to 9–10 cm, deeply dissected, often with additional pair of reflexed small lobes at base, median lobe with 2 pairs of large teeth at apex. Inflorescence a dense corymbiform panicle with rhachis and pedicels rather densely covered with short-stalked glands; flowers yellowish; samaras 2.8–3.5 cm long; young nuts scabrous-hairy and beset with glands, the mature usually glabrous, wings dilated and rounded above, the unripe bright pink, the ripe pale yellow, diverging at a very acute angle and often nearly parallel, with inner margins often contiguous or partly overlapping. Fl. May–June, Fr. September.

Mountain river valleys, mountain ravines and slopes, mostly in forests and shrubby thickets but also in exposed meadows up to 3,000 m. — Centr. Asia: Pam.-Al. (Alai Range and certain localities in Nura-Tau and Gissar Range), T. Sh. **Gen. distr.:** Iran. (Afghanistan). Described from Zailiiskii Ala-Tau. Type in Leningrad.

15. *A. tataricum* L. Sp. pl. (1753) 1054; M. B. Fl. taur.-cauc. II (1808) 496; Ldb. Fl. Ross. I, 454; Boiss. Fl. or. I, 948; Shmal'g., Fl. I, 207; Pax in Engl. Pflanzenr. (1902) 9; Medved., Der. i kust. Kavk. 34; Grossg., Fl. Kavk. III, 46. — *A. cordifolium* Moench, Meth. (1794) 55. — *A. rubrum* W. et K. Ic. pl. rar. Hung. II (1805) sub tab. XXVIII, non L. — Ic.: Pall. Fl. Ross. I (1784) tab. 111; Rchb. Ic. Fl. Germ. I (1842) tab. 162, f. 4824; Syreishch., Fl. Mosk. gub. II, fig. on page 347; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, fig. 23. — Exs.: G. R. F. No. 809.

604 Trees or tall shrubs with smooth dark gray or nearly black bark and reddish or brownish shoots hairy when young; leaves 6–10 cm long, 3–7 mm wide, dark green above, slightly paler beneath, hairy along nerves, oblong-ovate (f. *oblongofoium* Rac.) to suborbicular (f. *rotundifolium* Rac.), entire or slightly 3-lobed, irregularly biserrate at margin, sometimes undulate (f. *cuspidatum* Pax, garden), shallowly cordate at base, rarely truncate; petioles hairy, shorter than blades. Panicles dense, oval-corymbiform, with pubescent rhachis and pedicels covered with glands; flowers with yellowish sepals and white petals; samaras 3–4 cm long, with glabrous (f. *typicum* Blonsk. and f. *decalvens* Blonsk.) or pubescent (f. *hebecarpum* Blonsk. and f. *pubigerim* Blonsk.) nuts always beset with glands and tapering at base, wings dilated above, erect with nearly parallel outer margins (f. *genuinum* Rac.) or diverging at acute or nearly right angles (f. *slendzinskii* Rac.). Fl. May–June, Fr. from September.

Forest undergrowths and edges as individual trees or in small groups, gullies and ravines in forests, high river-banks, floodplains, riparian terraces and shrubby thickets on mountain slopes. — European part: M. Dnp., V.-Don, Transv., U. Dns., Bes., Bl., L. Don; Caucasus: Cisc., W. and E. Transc. (Kakhetia). **Gen. distr.:** Centr. Eur. (southern part), Bal.-As. Min., Arm.-Kurd., Iran (eastern part of Elburz Range). Described from "Tataria." Type in London.

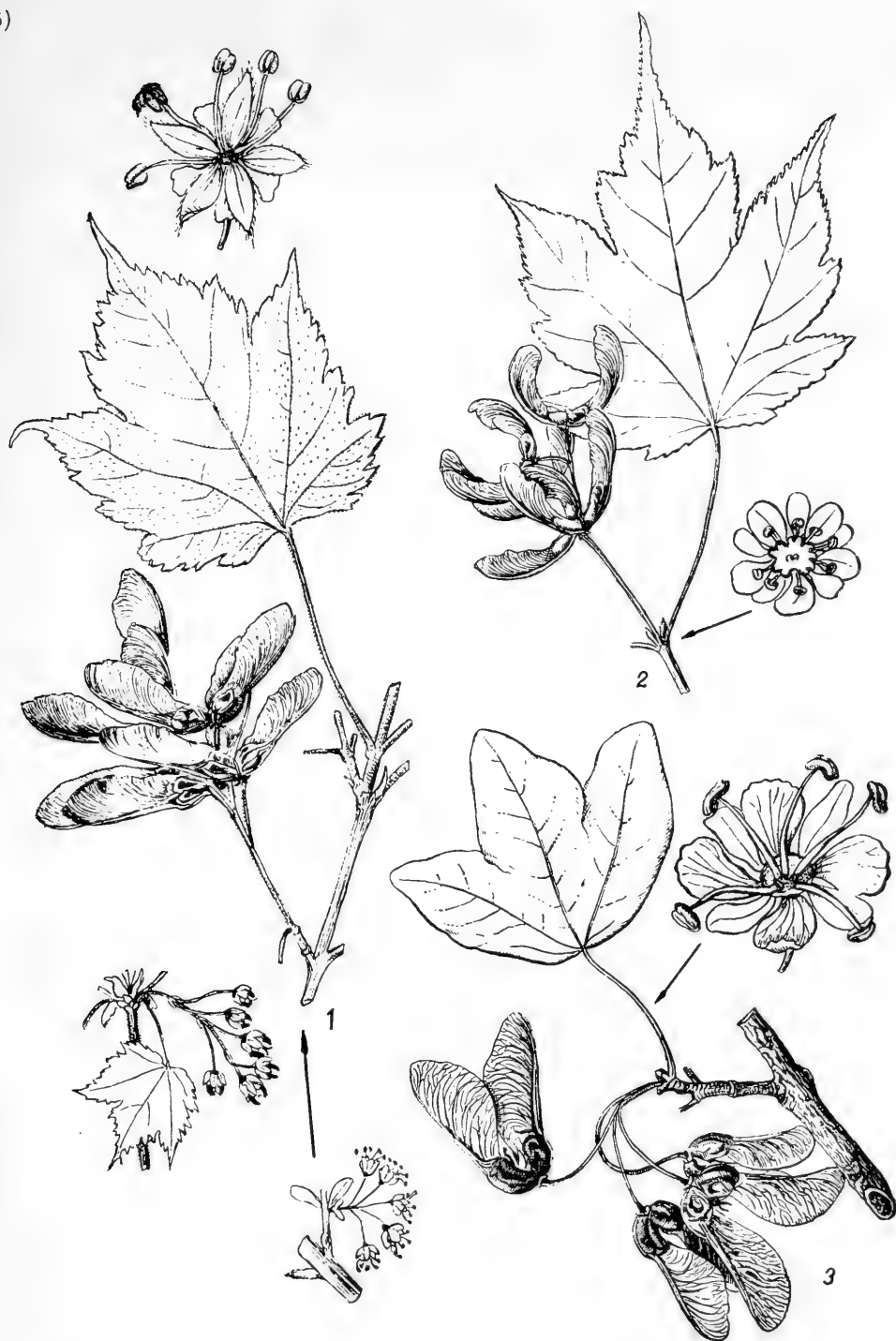


PLATE XXXII. 1 - *Acer barbinerve* Maxim.; 2; *A. komarovii* Pojark.; 3; *A. ibericum* M.B.

Section 4. *MICROCARPA* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 339.— Buds short-stalked, with 1–2 pairs of outer scales; leaves palmately 3–5–7-lobed; flowers 5-merous, staminate and bisexual, with free sepals and developed petals; stamens 8, inserted at inner margin of disk; samaras small, with inflated (cells) nuts covered with nerves. The section is composed of two series, of which only one is represented in the USSR and the other, *Sinensia* Pojark., includes the Chinese-Himalayan species.

Series 1. *Spicata* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 339.— Buds oblong, with 1 pair of outer scales; inflorescence a narrowly cylindrical spiciform raceme; petals narrowly linear. Three species found in C. China, the Himalayas, and the Atlantic coast of North America are included in this series in addition to the Russian species.

- 607 16. *A. ukurunduense* Trautv. et Mey. Fl. ochot. (1856) 24; Kom., Fl. Man'chzh. II, 722; Krisht. in Fl. Az. Ross. V, 41; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II, 726; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 339; Sugawara, Ill. Fl. Saghal. III, 1283.— *A. dedyle* Maxim. in Bull. Acad. St.-Petersb. XV (1856) 125.— *A. spicatum* Rgl. in Bull. Phys.-Math. Acad. St.-Petersb. XV (1856) 217, non Lam.— *A. spicatum* var. *ukurunduense* Maxim. Prim. Fl. Amur. (1859) 65; Koidz. in Journ. Coll. sc. Un-ty Tokyo, XXXII, 31.— *A. spicatum* var. *ussuriense* Budistsch., in Zap. otd. Russk. Geogr. Obshch. IX–X (1867) 108.— *A. caudatum* var. *ukurunduense* Rehd. in Sarg. Trees a. Shrubs, I (1905) 164.— *A. lasiocarpum* Lev. in Bull. Soc. bot. Fr. VI (1906) 59.— Ic.: Kom. and Alis. l. c. tabl. 220, fig. 2; Rehd. l. c. tab. LXXXII; Poyarkova, l. c. fig. 24; Sugawara, l. c. tab. 590.

Small trees, up to 14 m high, rarely shrubs, with soft yellowish-gray peeling bark and hard yellowish wood; juvenile shoots hairy only when young, brown or dark red; buds acuminate, laterally compressed, with 2 large outer dark red appressed-hairy scales, the two inner scales underneath brown, very densely hairy; leaves thin, up to 14 cm long on fertile shoots, usually orbicular-ovate, more or less deeply cordate at base, sparsely hairy above, soft-hairy beneath especially densely along nerves, very rarely glabrous from beginning, 5-lobed, with large broad median lobe and much smaller lateral ones, separated by acute usually narrow notches, sometimes lower lobes only slightly developed or absent, irregularly and largely bidentate at margin, gradually tapering to rather long mucro at apex; leaves on the long sterile shoots sparingly pubescent or even completely glabrous, deeply parted, sometimes nearly dissected. Raceme long, up to 15 cm, dense, consisting of up to 120 flowers, with densely hairy rhachis and pedicels and long-hairy lanceolate rapidly deciduous bracts; flowers small, developing much later than leaves; sepals oval-lanceolate, long-hairy; petals 2–3 times longer than sepals, linear-spatulate, glabrous; stamens glabrous, 2 times longer than petals; ovary densely hairy; samaras 1.5, infrequently up to 2 cm long, rarely slightly longer (var. *sachalinense* Nakai), with wings diverging at a right or more acute angle, nuts slightly inflated and pink when young, later brown, covered with nerves (but not alveolate), subglabrous when ripe. Fl. June, Fr. September.

Conifer or mixed forests, shrubby thickets on stony slopes, high riverbanks and river terraces; in Sakhalin it grows as a prostrate tree in its high-altitude distribution area. — Far East: Ze.-Bu., Uda, Uss., Sakh. Gen. distr.: Jap.-Ch. (Japan, Manchuria, Korea, Weichang in N. China). Described from Ukhurundu Range in Uda. Type in Leningrad.

Economic importance. Grown as an ornamental, sometimes confused with the American *A. spicatum* Lam. which is cultivated more frequently.

Section 5. PALMATA Pax in Engl. Bot. Jahrb. VI (1885) 326; VII (1886) 198. — Flowers staminate and pistillate (anthers abortive) in corymbiform few-flowered inflorescences, anthers; stamens inserted at inner margin of disk; samara nuts (cells) inflated, prominently nerved; leaves (5)7–11-lobed; buds sessile, with 1–2 pairs of outer scales.

About 12 very closely related species distributed mainly in Japan and Korea. One grows in C. China and one in California.

17. *A. pseudosieboldianum* (Pax) Kom., Fl. Man'chzh. II (1904) 725; Krisht. in Fl. Az. Rossii, V, 43; Nakai, Fl. Sylv. Koreana, I, 12; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II, 726; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 343. — *A. parvifolium* Buditsch. in Zap. Sib. otd. Russk. Geogr. Obshch. (1867) 108, non Tausch. — *A. sieboldianum* var. *mandschuricum* Maxim. in Mel. biol. XII (1886) 433. — *A. circumlobatum* var. *pseudosieboldianum* Pax in Engl. Bot. Jahrb. (1886) 200; Pflanzenr. VIII (IV, 163) (1932) 25. — Ic.: Kom. and Alis. l. c. tabl. 219, fig. 4; Poyarkova, l. c. fig. 25.

Small elegant trees, ca. 8 m high, with regular dense crown and gray bark; young shoots smooth, greenish or reddish with glaucous bloom; buds sessile, reddish, ovoid, with constricted-beaked apex, outer scales two, encircled at base with crown of yellow hairs; leaves up to 10 cm in diameter, orbicular, more or less deeply cordate at base, the juvenile bilaterally soft-hairy, later hairy only along nerves and at base of blade, usually palmately 9-lobed, rarely 11-lobed (mainly on sterile shoots); lobes broadly lanceolate, partly rhombic or triangular, acuminate, serrate or biserrate at margin; petioles $\frac{1}{2}$ to $\frac{2}{3}$ as long as blade, densely hairy at first, later sparsely so. Inflorescence long-pedunculate, corymbiform, 10–20-flowered, with hairy rhachis and glabrous pedicels; flowers developing later than leaves; sepals purple, oblong, acute; petals nearly half as long as sepals, yellowish-white, ovate; stamens slightly longer than sepals; ovary covered with few soon falling hairs; samaras up to 2 cm long, diverging usually at an obtuse angle, with wings sometimes incised at summit, nuts inflated with few but prominent nerves. Fl. June, Fr. September.

309 Mixed forests and leafy groves, forest edges, near streams, on well-drained sandy or stony soil. — Far East: Uss. (only southernmost part). **Gen. distr.:** Jap.-Ch. (Korea and SE Manchuria). Described from the Maritime Territory. Type in Leningrad.

Note. Some specimens of *A. pseudosieboldianum* vary in shape of wings of fruit, the magnitude of the angle at which they diverge, and the shape of leaf base. Nakai described several varieties from Korea,

but its variability in nature is still not fully described. Two varieties, var. *ambiguum* Nakai and var. *koreanum* Nakai, occur in the USSR, but var. *macrocarpum* Nakai, with fruits up to 2.8 cm long and broad nuts, has not been found among Russian specimens.

Section 6. *MACRANTHA* Pax in Engl. Bot. Jahrb. VI (1885) 328; VII (1886) 244. — Flowers staminate and pistillate (with abortive stamens) in monoecious or dioecious plants, in simple or sometimes spiciform racemes, 5-merous; stamens 8, epigynous, inserted at outer margin of disk; nuts (cells) winged, inflated; leaves 3–5-lobed or entire.

Series 1. *Tegmentosa* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 345. — Inflorescence a raceme; anthers smooth; ovary tomentose; leaves with 3 or 5 small lobes.

Seven species distributed in Japan (2), China (1), Manchuria and Korea (1 — USSR), Formosa (1), Himalayas (1), and eastern part of N. America (1).

18. *A. tegmentosum* Maxim. in Bull. Acad. St.-Petersb. XV (1856) 125; Pax in Engl. Bot. Jahrb. VII (1886) 246; idem in Pflanzenr. 8 (IV, 163) (1902) 62; Kom., Fl. Man'chzh. II (1904) 733; Krisht. in Fl. Az. Ross. V (1914) 61; Kom. and Alis., Opre del. rast. Dal'nevost. kr. II, 725; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 345. — Ic.: Nakai, Fl. sylv. Koreana, I, tab. XIII; Kom. and Alis. l. c. tabl. 219, fig. 2; Poyarkova, l. c. fig. 26.

Tall shrubs or trees up to 15 m high, with smooth bark remaining green in rather thick plants, later light greenish-gray; winter buds stalked, oblong, acuminate, with 1 pair of outer brownish-green scales and densely long yellowish hairy inner scales; leaves 9–17 cm long, 7–17 cm wide, orbicular- or oblong-tetrahedral, usually slightly dilated upwards, dark green above, paler beneath, glabrous, with characteristic membrane bearing tufts of rufous hairs only at angles of nerves, 3-lobate, rarely (usually only on sterile shoots) with additional pair of small lobes, some leaves sometimes entire, ovate, finely biserrate at margin, rounded to shallowly cordate at
610 base, upper lobes wide, partly developed, the median larger than the lateral, all abruptly tapering into a short mucro; petioles shorter than blades. Racemes loose, glabrous pendulous, terminal, developing later than leaves; flowers yellow; sepals oblong-oval, acute; petals tapering to claw, obovate; stamens approximately as long as petals and sepals, with glabrous filaments; fruits on pedicels 4–10 cm long, one-sided, glabrous; samaras 2.5–3 cm long, diverging at a very obtuse angle, wings obtuse, with nearly parallel margins or dilated above. Fl. at beginning of June, Fr. in September.

Dense conifer and mixed forests. — Far East: Ze.-Bu. (along Bureya River at the western border), Uss., Uda. **Gen. distr.:** Jap.-Ch. (Manchuria and Korea). Described from the lower Amur. Type in Leningrad.

Economic importance. Rarely cultivated. An ornamental.

★*A. pennsylvanicum* L. Sp. pl. ed. 1 (1753) 1055.— *A. striatum* Duroi, Handb. Baumholz. I (1772) 8.

Shrubs or trees, up to 12 m high, with broad crown and green, later brown, branches; juvenile leaves pubescent, later with rufous hairs only along nerves, thin, bright green, up to 10–18 cm long, 9–17 cm wide, orbicular, shallowly cordate at base, biserrate at margin, 3-lobed, sometimes with obsolete additional lower lobes; lobes broadly triangular, the median much larger than the lateral, the lateral more developed than in *A. tegmentosum*, all lobes terminating in a thin mucro; petioles $\frac{1}{4}$ to $\frac{2}{5}$ as long as blades. Racemes glabrous, pendulous, loose; pedicels glabrous, 8–13 mm long; flowers yellowish, 7–8 mm long; sepals oblong-oval; petals obovate, obtuse; stamens shorter than petals, with glabrous filaments; ovary glabrous; samaras 2.5 cm long, diverging at an obtuse or right angle, wings dilate in upper part and usually rounded. Fl. June, Fr. August.

Cultivated in the European part of the USSR. Gen. distr.: eastern part of Canada and U.S. Described from Pennsylvania. Type in London.

An ornamental tree that is rather frequent in dendrological gardens, sometimes confused with *A. tegmentosum* from which it differs by the shape of leaves and the less divergent samaras.

Series 2. *Micrantha* Pojark. in Tr. Botan. Inst. AN SSSR, ser. 1, I, (1933) 345.— Flowers in racemes, staminate or bisexual, plants dioecious; anthers scabrous, ovate, mucronate; ovary smooth; leaves palmately lobed, with incised-bidentate marginal lobes.

611 In addition to the Russian species, the series includes *A. tschonoskii* Maxim. on Hokkaido and Honshu islands in Japan, *A. micranthum* S. et L. on Honshu and Kyushu Islands, and *A. maximowiczii* Pax in C. China.

19. *A. komarovii* Pojark. in Addenda XIII, 746.— *A. tschonoskii* var. *rubripes* Kom., Fl. Man'chzh. II (1904) 736; Nakai, Fl. Sylv. Koreana, I, 21; Basargin in Sov. Bot. 1939, 8, 86.— Ic.: Nakai, l. c. tab. 14.

Small trees with gray bark, juvenile branches yellowish or reddish; winter buds stalked, the 2 outer scales wine-red, the inner carmine-pink tomentose at margin; petioles thin, red, at first sparsely yellowish-hairy, later glabrous, as long as blade or $\frac{2}{3}$ as long; blades 4–10 mm[cm] long, 2–9 cm wide, thin, bright green above, pale below, with tufts of hairs at axils of nerves, otherwise glabrous or rarely hairy beneath and along nerves, ovate to orbicular, cordate at base, 7-lobed; lobes ovate, the median distinctly larger than the upper lateral, often strongly elongating, all 3 lobes sharply tapering to a rather long mucro, usually cut into few large sometimes lobate teeth, two lower lobes small, acute, sometimes hardly distinct, biserrate at margin. Racemes at blossoming 4–6 cm long, few-flowered, erect; rhachis and pedicels (7–12 mm long) glabrous; flowers dioecious, yellowish, 5-merous; sepals linear-spatulate, obtuse, 3–4 mm long; petals like sepals but slightly longer; stamens 8, inserted outside the slightly notched disk; anthers orbicular-elliptic, distinctly mucronate; ovary glabrous; samaras 2–2.5 cm long, diverging at an obtuse angle, nuts oblong-ovoid,

slightly inflated, finely nerved, wings 4–6 cm wide, with parallel margins or slightly dilated above. Fl. beginning of June, Fr. second half of August. (Plate XXXII, Figure 2.)

Mixed mountain forests, singly or in small groups, 350–700 m, northern slopes mainly in loose areas. — Far East: Uss. (Kedrovaya Pad' nature reserve). Gen. distr.: Jap.-Ch. (Korea and adjacent Manchuria). Described from Kedrovaya Pad'. Type in Leningrad.

Note. V. L. Komarov distinguished the Korean specimens he had collected as var. *rubripes* Kom. of the Japanese *A. tschonoskii*, because he noted that the typical Japanese specimens differed from the Korean by many characters including longer anthers, wider and more deeply and thinly incised leaves. The new material collected at the Soviet-Korean border, where the plant had been first found several years ago, has confirmed Komarov's findings (except for the shape of the leaves and some other parts) and justified treating the mainland race as a separate species.

Section 7. *SACCHARINA* Pax in Engl. Bot. Jahrb. VI (1885) 328. — Flowers in short-pedunculate corymbiform inflorescences, staminate and pistillate with abortive anthers, monoecious but in different inflorescences; sepals adnate to petals in a calycine perianth; stamens inserted at inner margin of disk; samara nuts (cells) very inflated, woody; leaves 3–5-lobed, lobes entire with 1–2 pairs of large teeth above; buds ovoid, with 4–6 pairs of scales. Several (8) species in N. and C. America.

**A. saccharum* Marsh. Arbust. amer. (1785) 4. — *A. saccharinum* Wangerh. Nordamer. Holzpfl. (1787) 26, non L. — Ic.: Pax in Pflanzenr. 8 (IV, 163) (1902) f. 14.

Trees, up to 30–40 m high, with bright bark, brown glabrous shoots and grayish-brown branches; crown broad, spreading; leaves thin, two-colored, above dark green, shiny, paler beneath, tomentose when young, the adult yellowish, glabrous, 8–16 cm long and wide, cordate at base, 5-lobed, sometimes with slightly developed lower lobes, lobes sharply tapering to narrow mucro, entire, usually with 1, rarely the median with 2 pairs of large lobate teeth in upper part; petioles reddish, some longer, some shorter than blade. Flowers developing before leaves, greenish-yellow, in short-pedunculate compound corymbs; pedicels thin, 3.5–5 cm long, pendulous, covered with long white hairs; perianth 3.5–4 mm long, in staminate flowers narrowly campanulate, in the pistillate broadly campanulate, of 8 rather connate petals, sparsely long hairy at base and along margin; stamens twice length of perianth, with glabrous filaments; ovary sessile, tomentose, later glabrous; samaras ca. 3.5 cm long, diverging at a close to right angle, wings tapering at base, nuts brown, globose-trihedral, nerved. Fl. June, Fr. September.

Cultivated in the European part of the USSR, native to the northeast U. S. and E. Canada. Described from Virginia. Type unknown.

Economic importance. In Canada and the U. S. *A. saccharum* is grown for commercial purposes, for the maple sugar it contains. It is an ornamental tree distinguished by a handsome crown and leaves which turn orange and red in the fall.

Section 8. GONIOCARPA Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 347. — Flowers staminate and pistillate with abortive anthers, in monoecious plants; stamens inserted at inner margin of disk; inflorescences short-pedunculate or subsessile; samara nuts (cells) much inflated, trihedral, thick-walled; leaves 3–5-lobed, entire or with few large teeth above; buds with 8–12 scales.

Seventeen species in two series, distributed in the Mediterranean area from Algeria and Spain to SW Iran and Kopet Dagh.

Series 1. *Opulifolia* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 347. — Flowers in short-pedunculate many-flowered compound corymbs; samara nuts always glabrous inside; leaves commonly 5-lobed, rarely with undeveloped lower lobes, with few pairs of large teeth in upper part.

In addition to the Russian species there are 6 more distributed in S. Europe, N. Africa and Asia Minor.

20. *A. hyrcanum* Fisch. et Mey. in Ind. sem. Hort. Petr. IV (1837) 31; Ldb. Fl. Ross. I, 445; Boiss. Fl. or. I, 950, p. p.; Medved., Der. i kust. Kavk. 36; Grossg., Fl. Kavk. III, 48; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 348. — *A. opalus* Hohen. Enum. pl. Talysch. (1837) 155, non Ait. — *A. opulifolium* Ldb. l. c. non Vill.; Boiss. l. c. p. p. — *A. italum* ssp. *variabile* var. *crassifolium* Pax in Engl. Bot. Jahrb. VII (1886) 226. — *A. italum* ssp. *hyrcanum* Pax, l. c. 226. — *A. italum* Shmal'g., Fl. I (1895) 208, non Lauth, p. p. — *A. italum* ssp. *hyrcanum* var. *euhyrcanum* var. *crassifolium* Pax in Pflanzenr. 8 (IV, 163) (1902) 60. — Ic.: Pojark. l. c. fig. 30.

Tree, up to 15 m high, up to 30 cm in diameter; buds brown; juvenile shoots glabrous, reddish-brown; bark of branches grayish-brown; leaves thick, dark green and shiny above, pale, glaucescent or yellowish beneath, at first densely cobwebby-hairy, later subglabrous except for tufts at angles of nerves, 4.5–9 cm long, often elongating more at width than length, cordate at base, cut to the middle or less into 5 lobes, lobes ovate, wide (usually as long as wide), with short wide usually blunt cusp, 3 upper lobes subequal or the median slightly larger, with 1 or 2 large lobate teeth above middle and entire parallel margins below middle, lower lobes small, with few teeth or undulate; petioles usually shorter than blades. Flowers yellowish, small, in somewhat pendulous corymbiform panicles, developing simultaneously with leaves; rhachis and pedicels glabrous, pedicels 3–4 times longer than flowers; sepals obovate, 3.5 mm long; petals oblong-obovate, 4 mm long, sepals and petals glabrous; stamens twice length of petals; ovary hairy at first, later glabrous; samaras 2.5–3.5 (4.5) cm long, yellowish-brown, wings usually vertical, with parallel outer margins and often overlapping inner margins, rarely diverging at an acute angle, nuts shiny, brown, rather smooth, glabrous. Fl. June, Fr. September.

Mountain forests in the middle and upper forest belts, 800–1,900 m. — Caucasus: E. and S. Transc. Gen. distr.: Bal.-As. Min. (Artvin and Olty districts, Pontus Range), Arm.-Kurd. (Turkish Armenia) and Iran. (Elburz). Described from Talysch. Type in Leningrad.

Note. *A. sosnovskyi* Doluch. (Kolakovskii, Fl. Abkhazii, III, 125) is unknown and unclear to us; it is a species very close if not identical to *A. hyrcanum* F. et M. The description does not clarify its distinction from *A. hyrcanum*.

21. *A. stevenii* A. Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 142. — *A. opulifolium* Stev. in Bull. Soc. Nat. Mosc. XXIX, 1 (1856) 249, non Vill.; Boiss. Fl. or. I, 949, p. p.; Zelen., Mat. Fl. Kryma, 246; Taliev, Opredel. rast. Evrop. ch. SSSR (1927) 407. — *A. italum* Schmalh., Fl. (1895) 208, non Lauth. p. p. — *A. italum* ssp. *hyrcanum* var. *acutifolium* f. *tauricola* Pax in Pflanzenr. 8 (IV, 163) (1902) 60, p. p. — *A. italum* ssp. *hyrcanum* Vul'f and Palib., Opred. der. i kust. (1904) 583, p. p.; Vul'f in Trud. Nats. zap. Krym. (1919) 7. — *A. hyrcanum* C. K. Schn. Handb. Laubholz. II (1907) 235, non F. et M.; Vul'f., Fl. Kryma (1923) 12. — *A. italum* var. *opulifolium*, var. *tauricola* et var. *hyrcanum* Fedtsch. et Fler., Fl. Evrop. Ross. (1910) 623. — *A. hyrcanum* var. *tomentellum* f. *neglectum* cf. f. *divaricatum* Maleev in Izv. Nikit. Bot. Sada, X, 2 (1928) 49, non K. Maly. — Ic.: Poyarkova, l. c. fig. 5. — Exs.: Callier, No. 566.

Trees, up to 12 m high, with gray bark, brownish-gray branches and glabrous reddish-brown juvenile shoots; buds oblong-conical, with 8–10 brown scales; leaves thin, coriaceous, dark green above, pale beneath, glaucous, at first cobwebby-hairy, later completely glabrous except for tufts at angles of nerves, 4.5–8 cm long, usually broadening in width, cordate at base, cut to middle and deeper, for $\frac{2}{3}$ the length of blades into 5 lobes; lobes acuminate or cuspidate, the two lower small, much smaller than the upper, entire, with few teeth, the upper with 1–2 pairs of large lobate teeth above, with margins parallel below or tapering at base, length usually up to twice width; petioles as long as blades or slightly shorter, on
615 sterile shoots often longer than blades. Flowers yellow, small, in short-pedunculate spreading panicles; sepals ovate, obtuse, 4 mm long; petals obovate, slightly longer than sepals; stamens 1.5 times longer than petals; ovary hairy at first, later glabrous; samaras 2.5–3.8 mm long, wings vertical or slightly diverging, yellow-brown, tapering at base, nuts brown, shiny, ovoid, prominently few-nerved. Fl. June, Fr. September.

Mountain forests. — European part: Crim. Endemic. Described from between Foros and Mukhalatka in the Crimea. Type in Leningrad.

Series 2. *Monspessulana* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 355. — Inflorescence corymbose, subsessile, simple or rarely compound, few-flowered; samara cells (nuts) sometimes hairy inside; leaf of short fertile branches with usually entire lobes.

In addition to the Russian species, there are 7 more distributed in all the Mediterranean countries, Asia Minor and Iran.

22. *A. ibericum* M. B. Fl. taur.-cauc. II (1808) 447; III (1819) 643; C. A. Meyer, Enum. pl. cauc. casp. 206; Hohenack. Enum. pl. Talysch. 155; Rupr. Fl. Cauc. 231; Grossg., Fl. Kavk. III, 47; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 356. — *A. monspessulanum* Ldb. Fl. Ross. (1842) 455, non L. — *A. monspessulanum* var. *ibericum*

C. Koch, Dendrol. I (1869) 538; Trautv. in Tr. B. S. VII, 427; Pax in Engl. Bot. Jahrb. VII (1886) 229; in Pflanzenr. VIII (IV, 163) 62.—
A. talyschense Radde-Fom. in Izv. Kievsk. Bot. Sada, XII–XIII (1931) 73.—*A. talyschense* var. *sosnovskii* f. *dentata* Radde-Fom. l. c. 73.— Ic.: Fadde-Fomina, l. c. fig. I, II; Poyarkova, l. c. fig. 30.

Small trees, up to 8 m high; trunk with gray bark; annotinous shoots glabrous, light brown, the older grayish-brown; buds small, with 5–6 pairs of brown or grayish-brown scales; leaves coriaceous, glaucous-green, shiny and glabrous above, dull and paler beneath, densely cobwebby-hairy at first, later sparsely hairy at surface and along nerves, usually broadening, up to 7 cm long, 9 cm wide, rounded or cordate at base, 3-lobed; lobes subequal, ovate or triangular, obtuse or acute, usually entire but sometimes with 1–2 teeth near apex, on sterile shoots sometimes strongly dentate at margin; petioles glabrous, usually longer than blades. Corymbs sessile, pendulous, simple or rarely compound, with glabrous long pedicels; flowers developing simultaneously with leaves or slightly before them; calyx and corolla yellow, 4-merous, calyx broadly ovate, 4–4.5 mm long; petals oblong-obovate, slightly longer than sepals; stamens two times longer than corolla; ovary densely hairy; samaras 2.5–3.5(4) cm long, wings vertical, rarely diverging at an acute angle, dilated above, nuts woody, glabrous outside, hairy inside. Fl. June, Fr. July. (Plate XXXII, Figure 3.)

Central mountain belt, 700–1,800 m, dry forests of *Quercus macranthera* and shrubby thickets.—Caucasus: E. and S. Transc., Tal. Gen. distr.: Iran. (W. Elburz). Described from Georgia. Type in Leningrad.

13. *A. turcomanicum* Pojark. in Delect. sem. Hort. bot. Acad. Sc. URSS (1932) 3; Ej. in Tr. Bot. Inst. AN SSSR, ser. 1, I, 145.—*A. monspessulanum* Boiss. Fl. or. I (1867) 951, p. p.; Korsh. in Mem. Acad. Petersb. III, ser. IV, 16, 30, non L.—*A. monspessulanum* var. *genuina* f. *acutiuscula* Sinten. in O. and B. Fedch., Perech. r. Turk. II (1909) 146.—*A. monspessulanum* var. *turkestanicum* Lipsky, Lesn. rast. Turkest. (1911) 19, p. p.—*A. monspessulanum* var. *genuinum* Krysh. in Fl. Az. Ross. V (1914) 57.—*A. cinerascens* Lipsky, Lesn. rast. Turk. (1911) 19, non Boiss.; Fedch., Perech. r. Turk. Fl. II, 146.—*A. monspessulanum* var. *divergens* Radde-Fom. in Journ. de la Cycle bot. Acad. Sc. Ukraine, 3–4 (1932) 48.—*A. latcalatum* Radde-Fom. l. c. 49.— Ic.: Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933), fig. 1, 31 and 32.— Exs.: Edit. Horti bot. Petri Magni, No. 81.

Small trees with gray bark; juvenile shoots hairy, dark brown, later gray; buds 2–3 mm long, with dark brown scales nearly black at apex, fimbriate at margin; leaves with petioles usually longer than blades, densely hairy at base, 2–3.5–4 cm long, 2–5.5 cm wide, thin-coriaceous, glaucous-green, darker, shiny above, pale beneath, short-hairy especially along nerves, rounded or cuneate at base, rarely cordate, 3-lobed; lobes generally obtuse, lanceolate to ovate or broadly triangular, usually entire, rarely with few obsolete teeth, sometimes only on sterile shoots with 1–2 pairs of rather large teeth at apex. Inflorescences a compound or simple few-flowered (8–15) corymb, with glabrous pedicels 4 times longer than flowers; flowers greenish-yellow; sepals broadly oval, 4.5–5 mm long, sparsely ciliate at margin; petals obovate, slightly longer than sepals; stamens with glabrous

- filaments, in staminate flowers twice length of petals; ovary densely covered with long hairs; samaras 2–3(3.5) cm long, diverging at an acute angle, wings yellow, tapering at base, sometimes more or less strongly dilated above, nuts globose to ovoid, much inflated, hairy outside especially when young, usually sparsely pubescent up to ripening, lined with woolly hairs inside. Fl. April–May, Fr. August–September.
- 617 Slopes and bottoms of stony ravines in the woody-shrubby belt. — Centr. Asia: Mtn. Turkm. (Kopet Dagh). **Gen. distr.:** Iran. (E. Elburz). Described from Iolder gorge in W. Kopet Dagh. Type in Leningrad.

Section 9. TRIFOLIATA (Pax) Koidz. in Journ. Coll. Sc. Tokyo, XXXII (1911) 56. — Flowers staminate and pseudo-bisexual, monoecious, in terminal few-flowered umbels; stamens 8–12, inserted at inner margin of disk; samaras with much inflated woody nuts (cells); leaves compound, ternate; buds sessile, conical, with numerous scales.

Six species in E. Asia belonging to two different series.

Series 1. *Mandshurica* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 363. — Branches, leaves, inflorescences and ovary glabrous.

In addition to the Russian species *A. sutchuense* Fr. of Szechwan is included in this series.

24. *A. mandschuricum* Maxim. in Bull. Acad. St.-Pétersb. XII (1868) 228; Ej. Mel. biol. VI (1868) 371; Pax in Engl. Bot. Jahrb. VII (1886) 253; XI (1889) 80; Pflanz. VIII (IV, 163) (1902) 29; Kom., Fl. Man'chzh. II, 727; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II, 725; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 963. — *Negundo mandshurica* Budistch. in Zap. Sib. otd. Russk. Geogr. Obshch. IX and X; (1867) 107, 108, 137. — Ic.: Nakai, Fl. Sylv. Koreana, I, tab. X; Kom. and Alis. 1. c. tabl. 219, fig. 1; Poyarkova, 1. c. fig. 34.

Trees of average size, with uniform branching crown; bark gray or brownish-gray, shoots glabrous, reddish-brown; leaves ternate, with long thin reddish petioles; leaflets up to 8 cm long, 2.5 cm wide, equal or the median slightly larger, dark green above, paler beneath, at first long hairy on nerves, later glabrous or with hairs only at angles of nerves, often reddish along margin and nerves, lanceolate or oblong-elliptic, long-acuminate entire below, dentate or serrate above. Inflorescence short-pedunculate, 3–5-flowered; pedicels 2–3 cm long; flowers yellowish-green, developing simultaneously with leaves; sepals ovate, 7–8 mm long; petals slightly shorter than sepals; stamens usually 10(8–12), inserted at the inner margin of the well-developed disk, slightly longer than sepals; samaras up to 3–3.5 cm long, diverging at a right angle, wings dilated above and then cut and much inflated, nuts dark brown, prominently nerved. Fl. at beginning of June, Fr. September.

- 618 Mixed, rarely broadleaved forests, mostly at edges and in open places. — Far East: Uss. (southern part, not further north than Lake Khanka, and in the east up to Suchan River). **Gen. distr.:** Jap.-Ch. (all Korea). Described from S. Maritime Territory. Type in Leningrad.

Economic importance. An exquisite ornamental, deserving of cultivation

Section 10. *ARGUTA* Rehd. in Sarg. Trees and Shrubs, I (1905) 181.— Buds with 2 pairs of outer scales; leaves 3–5-lobed or entire, serrate at margin; flowers completely unisexual, dioecious, 4-merous, in few-flowered corymbs, the pistillate at ends of short leafy branches, the staminate developing from leafless lateral buds; stamens 4 at outer margin of disk, disk 4-lobed, obsolete in pistillate flowers; nuts alveolate-ribbed. A few species, distributed in SE Asia, belonging to one series, namely *Arguta* Pojark.

25. *A. barbinerve* Maxim. in Bull. Acad. Petersb. XII (1868) 27; Ej. in Mel. biol. VI (1868) 369; Pax in Engl. Pflanzenr. (1902) 72; Kom., Fl. Man'chzh. II, 736; C.K. Schneid. Handb. Laubholz. II, 245; Krisht. in Fl. Az. Ross. V, 63; Kom. and Alis., Opredel. rast. Dal'nevost. kr. II, 726; Poyarkova in Tr. Bot. Inst. AN SSSR, ser. 1, I, 366.— *A. diabolicum* ssp. *barbinerve* Wesmael in Bull. Soc. bot. Belg. XXIX (1890) 63.— Ic.: Nakai, Fl. Sylv. Koreana, I (1913) tab. XV; Kom. and Alis. l. c. tabl. 219, fig. 3; Poyarkova, l. c. fig. 35.

Small branching trees or large shrubs, 10–12 m high, with smooth, gray bark, shoots green or rarely red, later ash-gray; leaves thin, membranous, nearly unicolored, very sparsely hairy above, more densely so beneath especially along the nerves, usually deeply cordate at base, rarely truncate or subrounded, 3–5-lobed into large median lobe and much smaller upper lateral, the lower often large-toothed, much incised or bi-serrate at margin, the 3 upper lobes long-mucronate at apex; petioles as long as or longer than blades; leaves on sterile shoots larger, more deeply dissected, with much elongated median lobe and very large teeth. Corymbs 4–6-flowered, with hairy rhachis and glabrous or slightly hairy pedicels; pistillate flowers at ends of lateral branches, with 1 pair of leaves at base; sepals ovate, hairy at margin; petals oboval, glabrous; ovary glabrous; samaras up to 3.5 cm long, diverging at an obtuse angle, greenish, with characteristic ribbed-alveolate nuts. Fl. June, Fr. September. (Plate XXXII, Figure 1.)

Mixed and conifer mountainous forests, preferring edges and more open places, forest clearings and stony slopes.— Far East: Uss. (only in the Maritime Territory, extending along Sikhote-Alin to 45°N). Gen. distr.: Jap.-Ch. (Manchuria and N. and C. Korea). Described from S. Maritime Territory, from the sources of Lifudin. Type in Leningrad.

Economic importance. An ornamental plant, very rarely cultivated in the USSR.

Section 11. *RUBRA* Pax in Eng. Bot. Jahrb. VI (1885) 326.— Flowers in fascicles developing from individual lateral buds of 2 types: staminate and pistillate, with abortive stamens, with free or connate sepals (in different individuals), with or without petals; samaras with thin-walled oval nuts (cells); leaves 3–5-lobed, dentate; buds ovoid, with few pairs of imbricate scales.

Four species belonging to 2 different series.

Series 1. *Rubra* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 240.— Flowers with free sepals, petals and disk.

Two species in N. America: *A. rubrum* L. and *A. drummondii* Hook. et Arn., and one in Japan: *A. pycnanthum* C. Koch.

★*A. rubrum* L. Sp. pl. ed. 1 (1763) 1055.— *A. coccineum* Mchx. f. Arb. Amer. II (1810) 210.— *A. carolinianum* Walt. Fl. Carolin. (1788) 251.— *A. semiorbiculatum* Pax in Engl. Bot. Jahrb. VII (1886) 181.

Trees up to 25 m high, with loose broad crown, shoots red, glabrous, branches gray, bark smooth, dark gray; leaves 7–10 cm long and wide, shiny above, dark, glaucescent-green, beneath whitish-glaucous, at first more or less loosely tomentose, later glabrous, shallowly cordate at base, 5-lobed, median and upper lateral lobes with 1–2 large lobate teeth above, lower lobes sometimes inconspicuous, margins of all irregularly bidentate; petioles glabrous, usually red, slightly longer or shorter than blades. Inflorescence purple-red, fascicles of flowers umbelliform, dense; pedicels short; flowers developing long before leaves; sepals and petals oblong-obovate, obtuse; stamens 5–6 in staminate flowers, markedly protruding from corolla, inserted at outer margin of a lobate disk; pistillate flowers with glabrous ovary and short stamens with abortive anthers; samaras ca. 2 cm long, with wings diverging at a right or acute angle. Fl. April, Fr. at end of June.

620 Cultivated in the European part of the USSR, native to the Atlantic coast of N. America where it grows in marshes and at riverbanks. Described from the eastern part of N. America. Type in London.

Economic importance. An ornamental tree, in all seasons. In the spring it is wholly purple-red due to the dense inflorescences, in the fall it sparkles with bright red leaves, and the summer color of the crown is very handsome because of the whitish-glaucous lower side of the leaves. The sap has a high content of sugar. Yields honey for bees.

The cultivated *A. rubrum* L. is often confused with its vicariating species *A. drummondii* Hook. et Arn., distinguished by the 3-lobed leaves rounded or cuneate at base.

Series 2. *Saccharina* Pojark. in Tr. Bot. Inst. AN SSSR, ser. 1, I (1933) 240.— Sepals more or less connate; petals usually abortive; disk absent or rarely hardly developed.

A monospecific series.

★*A. saccharinum* L. Sp. pl. (1753) 1055.— *A. dasycarpum* Ehrh. Beitr. IV (1789) 24.— *A. eriocarpum* Mchx. Fl. bor.-am. II (1803) 203.—

Trees up to 30 m high, often producing several trunks, with very picturesque broad crown and thin drooping branches; petioles glabrous, green, rigid, shorter or longer than blades; leaves 6–12 cm long, 5–10 cm wide, green above, whitish-glaucous beneath, hairy when young, then glabrous, 5-lobed, lobes oblong-ovate, the median sometimes wider, irregularly dentate at margin, teeth partly large in 3 upper lobes, the upper sometimes

lobate. Flowers appearing before leaves, in dense fascicles; staminate flowers on thin, 6–8 mm long pedicels, calyx very small, 1.5 mm long, more than half-connate, petals and disk absent, filaments protruding, glabrous; pistillate flowers at first on pedicels 6–9 mm long, fruiting pedicels reaching 2–3 cm, rather thick, glabrous; calyx 4–4.5 mm long, petals sometimes present, stamens usually as long as calyx, with abortive anthers; ovary tomentose; samaras 3.5–4.8 cm long, nuts oval, slightly inflated, glabrous or sparingly pubescent, wings usually cordate, curved, dilated above and diverging at an acute angle. Fl. May, Fr. August.

Cultivated in the European part of the USSR, native to the eastern part of Canada and the U. S. Described from Pennsylvania. Type in London.

Economic importance. One of the most ornamental species of the genus. Of the several forms under cultivation the most striking are f. *wieri* Schwer. and f. *heterophyllum* Schwer. with their markedly dissected leaves. The species is distinguished by a very high content of maple sugar in the spring sap which is used for commercial purposes but not to the extent of *A. saccharum* Marsh.

Section 12. *NEGUNDO* (Ludw.) C. Koch, Deutsch. Dendr. I (1869) 513. — *Negundo* Ludwig, Gen. pl. ed. 3 (1760) 308. — *Negundium* Raf. in Desv. Journ. bot. II (1809) 170. — *Rulac* Adans. Fam. II (1763) 383. — Inflorescences developing from single lateral buds, disposed at both sides of leaf bud, plants dioecious; staminate flowers in fascicles, without rudimentary ovary, with 4–6 stamens; pistillate flowers in pendulous racemes, without staminodes; disk and petals absent; calyx of 5 proximally connate sepals; samaras with oblong or linear nuts (cells); leaves not paripinnate, with 3–5 leaflets.

This section comprises 3, very close, vicariating American species: *A. negundo* L. of the eastern part of N. America and eastern slopes of western mountains, *A. californicum* (Torr. et Gr.) Dietr. of the western part of N. American mountains, and *A. mexicanum* (DC.) Pax of C. America.

★*A. negundo* L. Sp. pl. ed. 1 (1753) 1056; Pax in Pflanzenr. 8 (IV, 163) (1902) 42. — *Negundo aceroides* Moench, Method. (1794) 334. — *Negundo virginianum* Medik. Pflanzenanat. (1800) 439. — *Negundo fraxinifolium* Nutt. Gen. North.-Am. pl. I (1818) 253; DC. Prodr. I, 596. — *Negundo negundo* Karst. Deutschl. Fl. (1883) 596. — *Negundium fraxinifolium* Raf. in Desv. Journ. bot. II (1809) 170. — *Rulac negundo* Hitch. ex Robinson in A. Gray. Syn. fl. I (1897) 440. — Ic.: Britt. a. Brown, Fl. N. St. a. Canada, ed. 2, II (1913) 498; C. K. Schn. Handb. Laubholzk. II, fig. 149, e–g; 150, a–g.

Trees up to 25 m high and up to 1 m in circumference, often producing few trunks, with gray bark and broad crown, branching and more or less drooping; juvenile shoots glabrous, green, with glaucous bloom, branches gray; leaves compound of 3–5 leaflets, with petioles 4–8 cm long, petiolules of lateral leaflets usually not longer than 1 cm, of the terminal 1.5–2.5 cm long; leaflets paler beneath, at first densely tomentose at both sides especially beneath, later glabrous, 5–13 mm long, 2.5–7.5 cm wide, ovate to

elliptic-lanceolate, usually mucronate at apex and regularly dentate at margin, sometimes subentire, terminal leaflet often 3-lobed. Flowers appearing before leaves, the staminate at first in dense fascicles, later pedicels markedly elongating (up to 4–7 cm) and drooping; calyx small, 1.5 mm long, narrowly campanulate, with 5 half-connate sepals, hairy like pedicels; stamens with filiform filaments and linear anthers, 3–3.5 mm long; pistillate flowers in loose pendulous racemes, calyx with sepals connate below; ovary hairy at first, later glabrous; samaras up to 3 cm long, diverging at a right or acute angle, nuts narrow-linear, prominently nerved, wings usually curved, tapering at base, dilated and rounded at apex. Fl. end of May, beginning of June, Fr. August.

Widespread in the European part of the USSR, Caucasus and Central Asia. Native to N. America: eastern states, eastern slopes of the Rocky Mountains, mountains of Utah, New Mexico and E. Arizona. Described from the eastern part of N. America. Type in London.

Economic importance. An ornamental tree planted in gardens and parks, lining streets and roads and also in steppe forests. It is distinguished by its rapid growth, drought-resistance, and yield of honey for bees (pollen). The variegated forms described as var. *pseudocalifornicum* Schwer. are very often cultivated in the south.

Family XCV. **HIPPOCASTANACEAE** * DC.

Flowers bisexual and staminate, arranged in one inflorescence, zygomorphous, with 5 sepals and 4–5 petals; stamens 5–8, free, inserted at inner margin of disk; ovary 3-locular with 2 ovules in each cell; style long and stigma entire. Fruit a coriaceous capsule dehiscing by 3 valves, 3-locular or 1–2-locular because of abortive septa; seeds without endosperm, with fleshy cotyledons. Trees, with opposite exstipulate leaves palmately compound of 3–5–9 leaflets.

Besides *Aesculus*, the family includes the genus *Billia* Peyr. with 2 species, 1 in Mexico and the other in the north of S. America.

Genus 871. **AESCULUS** ** L.

L. Sp. pl. ed. 1 (1753) 344

Calyx campanulate or turbinate, with 5 unequal lobes; petals with thickened canaliculate claws; disk annular or asymmetrical; capsule smooth or beset with prickles; leaves compound of 5–9 leaflets.

Thus far *Aesculus* has not been reliably treated.

Aesculiphyllum minus Nath. in Upper Oligocene Sakh. (Khoindzho).— *Aesculus* sp. in Oligocene Uss. (Rechnoi Peninsula).

* Treatment by A. I. Poyarkova.

** From the Latin *aescare* or *escare* – eat, because of the fruits, edible for cattle.

1. *A. hippocastanum* L. Sp. pl. ed. 1 (1753) 344; Ldb. Fl. Ross. I, 458; Grossg., Fl. Kavk. III (1932) 49. — *Hippocastanum vulgare* Gaertn. De fruct. et sem. II (1771) 135.

3 Trees up to 30 m high and 2 m in circumference, with large sticky buds and dense broad usually orbicular or sometimes pyramidal crown; leaves up to 20 cm long and 10 cm wide (on sterile shoots sometimes much larger), compound of 5–7 large sessile leaflets and with 15–20 cm long petioles; blades obovate or oblong, cuneately tapering at base, dilated and rounded above, abruptly mucronate, glabrous above, soft-hairy beneath along nerves, irregularly serrate at margin, median leaflet largest, the outer much smaller. Flowers in erect dense panicles up to 20–30 cm long, rhachis and pedicels rufous-hairy; calyx cylindrical-campanulate, pubescent; petals 5, with orbicular limb, fimbriate at margin, white, with yellow spot at base later turning pink; stamens hairy at base; ovary covered with soft hairs and prickles; capsules spinose, usually with 1 large seed.

Reported, apparently erroneously, by Eichwald for Mingrelia (W. Transc.).
Gen. distr.: N. Greece, Thessaly, Epirus. Described from Greece. Type in London.

Economic importance. Often cultivated in gardens and parks and also on city streets and country paths. The known forms under cultivation are those with double flowers, deeply cut blades, and the variegated forms. The most cultivated species of this genus are: *A. glabra* Willd. (Enum. pl. Berol. (1809) 405), with buds not sticky, pale green, leaflets more narrowly elliptic, acuminate, serrate, inflorescences smaller, flowers greenish-yellow, petals narrowly spatulate and fruits verrucose; distributed in the midwestern and eastern states of N. America; *A. pavia* L. (Sp. pl. ed. 1, p. 344), with red flowers and long-turbinate calyx, petals spatulate with long claws protruding from calyx, inflorescences 10–20 cm long, fruit smooth; small trees, 2–6 m high, with elliptic, acuminate, regularly serrate leaves up to 15 cm long and 6 mm [?] wide; distributed in the eastern states of N. America.

Family **SAPINDACEAE**

The genus *Sapindus* is widespread in the USSR from Oligocene (and, possibly, Eocene) to Pliocene deposits.

Sapindus cassioides Ett. in Sarmatian Bl. (Amvrosievka). — *S. falcifolia* A. Br. in Oligocene W. Transc. (Goderzi), Meotian W. Transc. (Guria). — *S. defuncta* Heer in Oligocene Sakh. (Mgachi). — *S. graeca* Ung. in Middle Eocene E. Transc. (Shor-Bulak, Dzhirvezh), Oligocene W. Transc. (Goderzi). — *S. hazslinskyi* Ett. in Sarmatian (Krynka, most reliable data). — *S. heliconia* Ung. in Oligocene W. Transc. W. Transc. (Goderzi). — *S. cf. oregoniana* Knowlt. in Upper Oligocene Sakh. (Rogatyi Cape). — *S. radobojana* Ung. in Sarmatian E. Transc. 24 (Kakhetian Range). — *S. undulata* Heer in Sarmatian E. Transc. (Kakhetian Range, Khvteebi, Norio). — *S. ungeri* Ett. in Oligocene W. Transc. (Goderzi), Sarmatian E. Transc. (Iora River, Tini-Seri, Norio, Kakhetian Range).

The genus *Cupania* was hesitantly noted only once.

Cupania longipes Heer (?) in Upper Oligocene Sakh. (Due, Mgachi).

The genus *Koelreuteria* occurs very sporadically.

Koelreuteria serrata Heer (?) in Upper Oligocene Sakh. (Mgachi).—

K. caucasica Palib. in Miocene E. Transc. (near Leninakan).

Family XCVI. **BALSAMINACEAE** * S. F. GRAY

Flowers bisexual, irregular; calyx abortive, sepals 3, of which one petaloid, colored, with more or less long spur; petals 5, of which one opposite the petaloid sepal and other 4 connate in pairs, thus the corolla appearing to consist of 3 petals; stamens 5, compactly appressed to ovary; pistils 1; ovary 5-locular, with axile placentas, cells with numerous ovules; stigmas sessile, simple, 5-parted; fruit a capsule; leaves alternate, opposite or whorled.

Representatives of the family are mainly distributed in the tropics and subtropics of the Old and New Worlds. The genus *Impatiens* L. includes about 750 species, and *Hydrocera* Bl., 1 species.

Genus 872. **IMPATIENS** ** L.

L. Sp. pl. (1753) 938

Two lateral small sepals herbaceous, spur of petaloid sepal not longer than flower (in Russian species); petals opposite the large spurred sepal suborbicular; stamens connate in upper part of filaments, free below; ovary oblong; capsule oblong, bursting in 5 valves rolling inwards thus scattering the seeds. Some species sometimes produce cleistogamous small flowers of another shape. Annual plants, with succulent, sometimes transparent stems, more or less thickened at nodes.

Among the tropical members of the genus there are perennial and acaulescent species.

1. Leaves alternate, crowded but not whorled towards ends of stems . . . 2.
- 625 + All leaves, or at least the upper, opposite or in whorls; large stalked glands at base of leaves . . . 10. *I. roylei* Walp.
2. Peduncles 2–5-flowered . . . 3.
- + Flowers solitary or few in axils of leaves; peduncles 1–2-flowered . . . 9. *I. balsamina* L.
3. Flowers yellow or white; spur straight or hamately curved below . . . 4.
- + Flowers lilac, spur spirally twisted . . . 5.
4. Flowers large, 2.5–3 cm long; peduncles pendulous; leaves obtusely dentate at margin . . . 6.
- + Flowers small, 1–10 mm long; peduncles erect; leaves acutely dentate or if obtusely then very small . . . 7.

* Treatment by E. G. Pobedimova.

** From the Latin *impatiens* – impatient, intolerant (ripe fruits split on contact, bursting as capsule valves are rolled inwards, scattering the seeds).

5. Flowers large, 3–4 cm long; petaloid sepals inflated, spur curved upwards or spirally rolled 4. *I. textori* Miq.
- + Flowers smaller, 1–2 cm long; sepals gradually tapering to spur, spur long, always spirally rolled 3. *I. furcillata* Hemsley.
6. Spur hamately curved below; petals with orange spots at throat 1. *I. noli-tangere* L.
- + Spur almost straight; petals without orange spots at throat, paler than in preceding species; flowers smaller 2. *I. maackii* Hook.
7. Leaves broadly ovate, small, 7–10 mm long, 6–8 mm wide; only cleistogamous flowers known, green, small, 1–1.5 mm long 5. *I. komarovii* Pob.
- + Leaves large, 50–70 mm long, 30–40 mm wide; flowers usually chasmogamous, large, 3–10 mm long 8.
8. Spur short, 0.5–1 mm, wide; lateral petals 2-lobed; flowers very small, 3–5 mm, white 7. *I. brachycentra* Kar. et Kir.
- + Spur long, 2–4 mm, narrow; flowers larger 9.
9. Flowers yellow; lateral petals 3-lobed, lobes upright 6. *I. parviflora* DC.
- + Flowers lilac; lateral petals 2-lobed laterally gibbous 8. *I. nevskii* Pob.

Economic importance. All species, including the unattractive *I. parviflora*, have been cultivated in gardens as ornamentals for many years. Some of them escaped locally.

Section 1. *Brachycentron* Warb. in E. u. P. Nat. Pflanzenfam. II, 4–5 (1897) 397. — Leaves alternate, crowded but not whorled towards ends of stems; peduncles 2–5-flowered.

26 **Series 1. *Macropetalae* Pob.** — Flowers large, 2.5–3 cm long, yellow or white; spur hamately incurved below, rarely straight; peduncles pendulous.

1. *I. noli-tangere* L. Sp. pl. ed. 1 (1753) 938; DC. Prodr. I, 687; Ldb. Fl. alt. I, 265; Ej. Fl. Ross. I, 687; Boiss. Fl. or. I, 867; Shmal'g., Fl. I, 200; O. and B. Fedch., perech. r. Turk. II, 152; Kom., Fl. Kamch. II, 302; Grossg., Fl. Kavk. III (1932) 49; Kom. and Alis., Opre del. r. Dal'nevost. kr. II, 726; Kryl., Fl. Zap. Sib. 8, 1887; Maevsk. Fl. (1940) 505. — *I. noli me-tangere* Crantz, Inst. II (1766) 430. — *I. lutea* Lam. Fl. Fr. II (1776) 666. — *I. palustris* Pers. Syn. II (1805) 257. — *I. borealis* Sweet, Hort. Brit. ed. II (1830) 588. — *I. caucasica* Stev. in Ann. Sc. Nat. V, 12 (1849) 374. — *I. pachycentra* Rupr. Fl. Cauc. I (1869) 265. — *I. nolitangere* var. *minutiflora* Meinsh. Fl. Ingr. (1878) 75. — *I. penduliflora* St. Lag. in Ann. Soc. Bot. Lyon, VII (1880) 128, 70. — *I. cleistogama* M. Pop. in Mater. issl. rast. Kazakhstana, II (1941) 30. — Ic.: Rchb. Ic. Fl. Germ. f. 4483; Fedch. and Fler., Fl. Evr. Ross. (1910) 623; Kom. and Alis. l. c. tabl. 221. tabl. 221. — Exs.: Fl. Polon. exs. No. 153; G. R. F. No. 257; Fl. Stir. No. 4014; Fl. It. No. 1715.

Glabrous annuals; root fibrous; stems erect, more or less branching, 40–120 cm high; leaves ovate or elliptic, short-acuminate, largely and obtusely dentate, 5–10 cm long, 2–5 cm wide, the lower with petioles 2–4 cm long, broadly cuneate at base, the upper sessile, rounded at base. Peduncles 2–3 cm long, axillary, disposed under leaves; flowers 3–5, on pendulous pedicels, large, 2.5–3 cm long, lemon-yellow with reddish spots at throat; lateral sepals broadly ovate, acute, keeled at apex, spur of petaloid sepal hamately curved; lateral petals 2-lobed, 1 lobe large, wide, and the other adjacent small; capsules linear-oblong. July–August.

Forest ravines and rivers, in deep shade of conifer and mixed forests, streams, riparian woodland, marshes. — European part: Dv.-Pech., Lad.-Ilim., U. Dnp., M. Dnp., U. V., Bl., V.-Don, V.-Kama, Transv.; Caucasus: in all regions except for Tal.; W. Siberia: U. Tob., Ob, Irt., Alt.; E. Siberia: Yenis., Dau., Ang.-Say., Lena-Kol.; Far East: Ze.-Bu., Uda, Sakh., Okh., Kamch., Uss.; Centr. Asia: Dzu.-Tarb., T. Sh. (rarely). **Gen. distr.:** Scand., Atl. Eur., Centr. Eur., W. Med., Bal.-As. Min., Jap.-Ch. Described from Europe. Type in London.

627 **Note.** In the herbarium of the Botanical Institute of the Academy of Sciences of the USSR there are several specimens of *I. noli-tangere* with slightly smaller leaves and flowers nearly exclusively cleistogamous (Pechora River, Pskov, Luga), which Meisshausen separated into var. *minutiflora* Meissh. On the Pechora River (extreme north of the distribution area), in Pskov and Luga, these forms occur in felled areas and peat bogs which are ecologically atypical. M. G. Popov found a form of *I. noli-tangere*, also only with cleistogamous flowers, at the extreme southern boundary of this species, which he proposed as the species *I. cleistogama* M. Pop. We cannot accept this distinction because there is insufficient proof. In the literature it is stated that cleistogamous flowers in the delicate specimens of this species appear in deep shade in June while chasmogamous flowers on the same specimens appear later, at the end of June and beginning of July. Transitions occur between both forms. In America this species vicariates with *I. pallida* Nutt., easily distinguished by the structure of the flowers.

2. *I. maackii* Hook. in herb.; Kom. and Alis., *Oprel. r. Dal'nevost. kr. II* (1932) 726.

Glabrous, strongly branching annuals; leaves elliptic or ovate, 2–3.5 cm long, 1.5–2.5 cm wide, petiolate, obtusely large-toothed, entire at the cuneate base, obtuse at apex; petioles of lower leaves 2–3 cm long, of upper 0.5 cm. Peduncles axillary, 3–5-flowered, disposed under leaves; flowers pendulous, smaller and paler than in the preceding species, not spotted at throat; spur of petaloid sepal hardly curved; lateral petals 2-lobed, with 1 large wide lobe and 1 small adjacent one; petals wide, 4 mm long, 8 mm wide, keeled, opposite the spurred sepal; capsules linear-oblong. August–September. (Plate XXXIII, Figure 4.)

Banks of rivers and streams. — Far East: Uss. (Sungacha River, Krivoi Klyuch on Suputinka River, Bol'shoi El'dush River). Described from Sungacha River, source of Ussuri River near Lake Khanka. Endemic? Type in Leningrad.

Note. The characters readily distinguishing this species from *I. noli-tangere* (color of the flowers) are lost in herbarium specimens, thus making it difficult to establish its precise distribution area. Hooker, who separated this species as *I. maackii*, did so from a herbarium specimen to which he attached a personally signed drawing of the flowers.

Series 2. *Circinatae* Pob.— Flowers large (1–4 cm), lilac; spur spirally rolled or curved upwards; peduncles in axil of leaves, erect.

3. *I. furcillata* Hemsley in Forbes and Hemsley, Index Fl. Sinensis, I (1888) 101; Kom., Fl. Man'chzh. II, 741; Kom. and Alis., Oprel. r. Dal'nevost. kr. II, 733.

Annual; root fibrous; stems erect, 0.5–1 m high, simple or branching, nodose, glabrous below, sparsely dark brown hairy above; leaves rhombic-lanceolate, 1–13 cm long, 0.5–2.5 cm wide, decurrent along petioles, acute at apex, serrate with large irregular mucronate teeth. Peduncles axillary, 5–10 cm long, more or less densely dark hairy, branching above; bracts small, oval-acuminate; pedicels lateral, bearing 1 flower; flowers lilac, 1–2 cm long, lip whitish, pale lilac below, spur dark violet above with purple spots inside, thin, long, 1.5 cm, spirally twisted at tip; lateral sepals greenish; lateral petals protruding, pink, with red spots; capsules irregular, often 2–3-seeded, with short prickles at summit. July–September. (Plate XXXIII, Figure 5.)

Streams in forests, wooded valleys, springs, clayey-gravelly soil, rarely in open spaces.— Far East: Uss. Gen. distr.: Jap.-Ch. (Manchuria, Korea). Described from Korea. Type in London.

Note. This species is rather similar to *I. textori* Miq. and it is often difficult to distinguish between them.

4. *I. textori* Miq. in Ann. Mus. Bot. Lugd.-Bat. II (1865–1866) 76; Kom. and Alis., Oprel. r. Dal'nevost. kr. II, 733.— Ic.: Useful Pl. Jap. III (1895) 777.

Annuals; stems erect, slightly branching, glabrous like leaves or sometimes with dark brown hairs above; leaves alternate, 9–13 cm long, 3–6 cm wide, nearly crowded in whorls at apex, predominantly elongate, petiolate, rhombic-ovate, acute, cuneate at base, dentate-crenate at margin, apical teeth with bristles; petioles 2–4 cm long, glabrous. Peduncles terminal, 2–3, longer than leaves, corymbiform-racemiform in upper part, 4–10-flowered, axillary peduncles few-flowered; bracts small, 3–5 mm long, lanceolate-ovate; pedicels thin; flowers lilac, abortive flowers sometimes present, lateral sepals ovate, shortly obtuse-acuminate; petaloid sepal campanulate-infundibular, inflated then elongating into short spur, spur curved upward or spirally rolled; posterior petal smooth, saccate, the lateral connate petals 2-lobed, posterior lobes narrowly oblong, the anterior short, linear, crenate at margins, glandular; capsules oblong, 10–15 mm long, 2–3 mm wide, with 2 dark longitudinal stripes and mucro at apex.

Forest streams, ravines.— Far East: Uss. (Sedanka). Gen. distr.: Jap.-Ch., Korea. Described from Japan. Type in Sweden.

(629)



PLATE XXXIII. 1 - *Impatiens brachycentra* Kar. et Kir., habit, lateral sepal, sepal with spur, 2 lateral connate petals, posterior free petal; 2 - *I. nevskii* Pob., lateral sepal, sepal with spur, 2 lateral connate petals, posterior free petal; 3 - *I. parviflora* DC., lateral sepal, sepal with spur, 2 lateral connate petals, posterior free petal; 4 - *I. maackii* Hook.; 5 - *I. furcillata* Hemsley.

Note. This species was apparently introduced into the USSR since it was collected only once near the railway station Sedanka not far from Vladivostok.

5. *I. komarovii* Pob. in Bot. Zhurn. SSSR, XXXIV, 1 (1949) 65.

Annuals; root fibrous; stems 30 cm high, erect, cylindrical, glabrous, furrowed, branching; leaves small, 8–10 mm long, 6–8 mm wide, broadly ovate or suborbicular, sparsely large-toothed at margin, glabrous, the upper narrower, acute at apex, often dentate with acuminate teeth at margin, sometimes with shortly pubescent, short-petiolate, petioles 3–4 mm long. Racemes 2-flowered, axillary; peduncles very thin, conspicuous, shorter than leaves, 3–7 mm long; bracts linear, acute, 2–3 mm long; flowers small, 1–1.5 mm long, only the cleistogamous known; lobes of perianth 4, subregular, free, strongly acute at apex; stamens 5, filaments broad, tightly attached to ovary; anthers oblong, acute, inclined towards stigma; ovary obovoid; stigma lobes hardly visible; capsules small, 2–3 mm long, 1–2-seeded, oblong, acuminate at apex, green, smooth, with broad dark violet longitudinal stripes. September.

Mixed forests, banks of streams. — Far East: Uss. Endemic. Described from Sikhote-Alin, from the pass near Takhe River. Type in Leningrad.

Note. There is only one specimen of this species in the Herbarium of the Botanical Institute of the Academy of Sciences of the USSR, which was collected in the fall (September). It is possible that the plant blooms with chasmogamous flowers in the summer. Of the two genetic series of *Impatiens* known from the Far East, *I. komarovii* stands closer to the series *Circinatae*, although the structure of the chasmogamous flowers, typical for this series, is not known for this new species.

Series 3. *Micropetalae* Pob. — Peduncles in axils of leaves, erect; flowers small, up to 1 cm long; spur straight.

6. *I. parviflora* DC. Prodr. I (1824) 687; Ldb. Fl. alt. I, 265; Ej. Fl. Ross. I, 481; Shmal'g., Fl. I, 201; B. Fedtsch. in Tr. B. S. XXIII, 514; O. and B. Fedch., Perech. r. Turk. II, 152; Kryl., Fl. Zap. Sib. VIII, 1888; Maevsk., Fl. (1940) 505. — *I. parviflora* var. *typica* Trautv. in Bull. Soc. Nat. Mosc. XXXIII, 1 (1860) 463. — Ic.: Ldb. Ic. Pl. Fl. Ross. I (1829) tab. 89; Hegi, Ill. Fl. V, 1 (1925) 318. — Exs.: H.F.A.M. No. 73; Pl. Finl. exs. No. 286; Fl. Bohem. et Morav. No. 67; Fl. silesiaca, No. 179; Fl. Styr. No. 31; Fl. austro-hung. No. 487.

322 Glabrous annuals; root fibrous; stems erect, 30–60 cm high, succulent, thickened at nodes; leaves elliptic or ovate, 8–17 cm long, 4–8 cm wide, acuminate at apex, cuneate at base, short-petiolate, decurrent along petiole down to stem, acutely serrate-dentate, subentire at base, teeth glandular, glands large, especially at base. Peduncles axillary, as long as leaves, strict, 4–12-flowered; flowers small, up to 1 cm long, lemon-yellow, red-spotted at the throat, erect; spur of outer sepal 4–5 mm long, straight, sometimes clavate at summit; lateral sepals 2 mm long, 1–1.5 mm wide, ovate, entire, keeled, keel greenish; lateral petals connate in pairs, 3-lobed, pale yellow with reddish spots; petals opposite the spurred sepals, sub-orbicular, 5 mm long and wide, keeled, yellow; filaments dilated at apex,

connate, the lower bent; stigmas 5; capsules linear-oblong, cylindrical, strict or slightly declinate. July–August. (Plate XXXIII, Figure 3.)

Banks of rivers and streams, ravines and stony mountain slopes, damp shady places, also as a weed and locally escaped in gardens, fences, yards. — European part: M. Dnp., U. V., Lad.-Ilm.; W. Siberia: Irt., Alt. (Barnaul); Centr. Asia: Dzu.-Tarb., Balkh., T. Sh., Syr D., Pam.-Al. **Gen. distr.:** Dzu.-Kash., Ind.-Him., Mong., Scand., Centr. Eur., Atl. Eur. Described from W. Siberia, from the upper reaches of the Irtys River. Type in Leningrad.

Note. In Central Asia this species is locally escaped; it is very polymorphous and its fine distinctions, in the shape and color of the flowers, are not readily seen in the herbarium specimens. It should be studied in nature.

7. *I. brachycentra* Kar. et Kir. in Bull. Soc. Nat. Mosc. XV, 1 (1842) 179; Ldb. Fl. Ross. I, 482; Hook. Fl. Brit. Ind. I, 481. — *I. parviflora* var. *brachyceras* Trautv. in Bull. Soc. Nat. Mosc. XXXIII, 1 (1860) 464. — *I. parviflora* var. *brachycentra* B. Fedtsch. in O. and B. Fedch., Perech. r. Turk. II (1909) 152. — **lc.:** Bull. of Miscell. Inf. No. 10 (1920) 349.

Annuals; flowers small, 3.5 mm long, milk-white, erect; spur of petaloid sepal short, 1–1.5 mm long; broad, cuneate; lateral petals connate, 2-lobed. Otherwise not differing from the preceding species. July–August. (Plate XXXIII, Figure 1.)

Shady, conifer mountain forests, predominantly spruce, 1,000–2,000 m. — Centr. Asia: Dzu.-Tarb., T. Sh. **Gen. distr.:** Dzu.-Kash. (Kuldja). Described from Dzungarian Ala-Tau, Baskan River. Type in Leningrad (izd. Kar. i Kir. No. 1339).

8. *I. nevskii* Pob. sp. nova in Addenda XIII, 746.

633 Annuals, 20–60 cm high; stems erect, branching; leaves broadly elliptic, acuminate at apex, cuneate and subentire at base, acutely serrate-dentate, long-petiolate (petioles 2–3.5 cm long), decurrent along petiole, glabrous. Peduncles axillary, 6–12-flowered; flowers up to 1 cm long, lilac, with reddish spots at throat, erect; spur of petaloid sepal 2–5 mm long, straight; lateral sepals ovate, entire, keeled; upper petal keeled, large, saccate, dorsally green, the lateral connate in parts, 2-lobed, lobes gibbous at one side, flexuose and greenish at margin; filaments dilated, connate under anthers; capsules linear-oblong, cylindrical. June. (Plate XXXIII, Figure 2.)

Ravines, damp fissures. — Centr. Asia: T. Sh. (Fergana, Malaya Almaatinko River), Pam.-Al. (Kugitang). Described from Kugitang. Type in Leningrad.

Note. According to Nevskii and Popov, the yellow-flowered *I. parviflora* does not occur at all in Kugitang; in W. Tien *I. nevskii* grows together with *I. parviflora*.

Section 2. MICROCENTRON Warb. in E. u. P. Nat. Pflanzenfam. III, 4–5 (1897) 391. — Apical leaves alternate, numerous, but not in whorls; flowers solitary or few in axils of leaves; peduncles 1–2-flowered.

9. *I. balsamina* L. Sp. pl. (1753) 938; Roxb. Fl. Ind. (1832) 651; Shmal'g., Fl. I, 201; B. Fedch. in Tr. B. S. XXIII, 515. — *Balsamina hortensis* Desp. Dict. sc. nat. 3 (1816) 485. — Ic.: Hegi, Ill. Fl. V, 1, 311.

Annuals; stems erect, hardly branching, 25–45 cm high; leaves lanceolate, narrow, 8–14 cm long, 1.5–2 cm wide, acuminate at apex, narrowly cuneate at base, decurrent along petiole, serrate at margin. Pedicels short; flowers clustered in axils of leaves, erect, large, 2.5–3.5 cm long, white, pink, purple or variegated, sometimes double; spur of petaloid sepal long, 1–1.5 cm, curved; capsules ovoid, pubescent. Fl. July–August, Fr. August–September.

Cultivated in gardens in the southern part of the Far East, Central Asia, Asia Minor and S. Europe. Described from India. Type in London.

Section 3. *SALPIGLOCHILON* Ward. l. c. in E. u. P. Pflanzenfam. III, 4–5 (1897) 391. — All leaves, or at least the upper, opposite or in whorls; flowers few in racemes.

10. *I. roylei* Walp. Rep. I (1842) 475; Haak. Fl. brit. Ind. I, 481; Syreishch., Fl. Mosk. gub. IV, 124; Maevsk., Fl. (1940) 505; Enar. et Eichw. Kodum Taimest. (1943) 274. — *I. royleana* Payer. Organog. Comp. (1857) 84. — *I. glandulifera* Royle, Illustr. (1839) 151, tab. 28, f. 2, non Arn. 1835. — *I. glandulifera* Lindl. Bot. Reg. (1840) tab. 22. non Arn. 1835. — *I. moschata* Edgew. in Trans. Linn. Soc. XX (1846) 38. — Ic.: Hook. Bot. Mag. tab. 4020; Bois. Atlas Pl. Jard. (1896) tab. 63, Hegi, Ill. Fl. V, 1, 312.

634 Annuals; erect plants, up to 2 m high, branching from base; leaves whorled, 3 in node, rarely opposite, large, 6–12 cm long, 2–4 cm wide, acuminate at apex, rounded at base, petiolate, decurrent along petiole, acutely serrate at margin, teeth mucronate, with stalked dark red glands at base. Peduncles mostly in axils of upper leaves, forming a terminal inflorescence, branching, many-flowered, 2–14-flowered, strict; flowers large, 3–3.5 cm long, lilac-pink; spur of petaloid sepal short, 4–5 mm, greenish; capsules obovoid, attenuate towards base, with spinose cusp at apex. August–September.

Cultivated in gardens and easily escaping, escaped forms occurring in quantities along banks of streams and lakes. — European part: U. V. (Seliger Lake — S. V. Yuzepchuk; Senezhskoe Lake — Zolotarev), Balt. (Estonia). **Gen. distr.:** Ind.-Him., Centr. Eur. Described from W. Himalayas. Type in London.

Order 26. **Rhamnales*** ENGL.

Flowers cyclical, regular, with double perianth, disk and 1 circle of stamens; ovary 2–5-locular; ovules with dorsal, ventral or lateral suture and 2 integuments, 1–2 in each cell. Trees, shrubs or climbers; leaves simple, rarely compound, with stipules; inflorescences cymose.

* Treatment by V. I. Grubov.

Family XCVII. **RHAMNACEAE** R. BR.

Flowers bisexual or unisexual in dioecious plants, 5-4-merous; petals small (or completely absent), alternating with the triangular deciduous lobes of calyx and opposite to the stamens; disk intrastamineal; style erect, with 2-3-(4-) partite or lobate stigma; ovary 2-3-(4-) locular, with 1 basal ovule in each cell; fruit drupaceous or dry, indehiscent; seeds usually oval, compressed, with slightly developed cartilaginous perisperm; embryo large, erect, axile, with large flat cotyledons.

Shrubs or small trees, often spiny; leaves simple, entire, alternate, rarely opposite; flowers small, inconspicuous, greenish, in axillary fascicles, or cymose inflorescences.

There are about 50 genera and more than 500 species in the family widely distributed throughout the world, mainly in the tropics and subtropics.

635 The genus *Berchemia* has thus far been described only from the Caucasus.

Berchemia multinervis A. Br. in Sarmatian E. Transc. (Khvtebi, Norio Patardzeuli).— *B. aff. multinervis* A. Br. in Oligocene W. Transc. (Goderzi).

The genus *Hovenia* was found only in Paleocene Far East.

Hovenia thunbergii (Nath.) Baik. in Paleocene Amur (Raichikha).

Key to Genera*

1. Leaves asymmetrical, 3-nerved, with hard prickly basal stipules . . . 2.
- + Leaves usually symmetrical, with pinnate venation and small squami-
form deciduous stipules 3.
2. Fruit dry, discoid 873. *Paliurus* Mill.
- + Fruit succulent, a "drupe" 874. *Zizyphus* Mill.
3. Flowers sessile in clusters, spicately arranged at ends of branches;
shrubs, with decussate opposite spinose branches and small coriaceous
leaves 875. *Sageretia* Brongn.
- + Flowers on more or less long pedicels in axillary fascicles, cymose
umbels or, rarely, racemes; branches and leaves usually alternate or
diagonally opposite 4.
4. Buds glabrous, naked; leaves with almost straight parallel nerves;
flowers 5-merous, bisexual; seeds lenticular, not furrowed
- 876. *Frangula* Mill.
- + Buds scaly; plants usually dioecious, flowers 4-merous in fascicles or,
rarely, 5-merous in racemes but never in umbelliform inflorescences;
seeds usually ovate, furrowed 877. *Rhamnus* L.

Tribe 1. **ZIZYPHEAE** Benth. et Hook. Gen. pl. I (1862) 372.— Fruit drupaceous, stone 1-3-locular indehiscent; flowers bisexual, 5-merous; ovary semiinferior, adnate to receptacle; disk usually flat, pentagonal, free at margin; leaves with 3 basal nerves and hard spinose persistent stipules at base.

* In view of the impossibility of distinguishing the genera only by leaves and other vegetative characters, and for the purposes of brevity and simplicity, the Key is based on mixed characters. For the most part there can be no exact determination of the species of this family without developed fruits.

Genus 873. **PALIURUS** * Mill.

Miller, Gard. Dict. ed. 8 (1768)

Calyx saucer-shaped, with broadly triangular spreading lobes; petals small, spoon-shaped, embracing stamens; style 2-3-lobed; ovary 2-3-locular; fruit turbinate, with dry spongy mesocarp and stony endocarp, with coriaceous annular rim at margin; seeds smooth, not furrowed.

636 Shrubs; leaves alternate, biserial, with pair of prickly stipules at base, one of which erect, obliquely antrorse and the other recurved, hamate; inflorescences axillary, cymose. Anemochory.

Six known species, distributed in E. Asia.

The genus *Paliurus* was observed in Paleocene to Sarmatian deposits.

Paliurus colombii Heer in Paleocene L. Don (Osinovoe, Tarasovka), Oligocene Sakh. (Mgachi), Paleocene Yakutia (Chirkmyi-Kaya). —

P. zaporogensis Krysht. in Sarmatian Bl. (Orekhov). — *Paliurus* sp. in Paleocene Amur (Raichikha).

1. ***P. spina christi*** Miller, Gard. Dict. ed. 8 (1768); Hegi, Ill. Fl. V, 1, 326; C.K. Schn. Laubholz. II, 260; Grossg., Fl. Kavk. III, 50. — *Rhamnus paliurus* L. Sp. pl. (1753) 194; Pall. Fl. Ross. II, 27. — *P. australis* Gaertn. De fruct. I (1788) 203; B. Fedch., Rast. Turk. 565. — *P. aculeatus* Lam. Tabl. Encycl. III, II (1793) 347; DC. Prodr. II, 12; Ldb. Fl. Ross. I, 500; Shmal'g., Fl. I, 205. — *P. trinervatus* Moench, Meth. (1794) 74. — *Zizyphus paliurus* Willd. Sp. pl. I (1797) 1103; M. B. Fl. taur.-cauc. I, 169. — Ic.: Pall. l. c. tab. 64; Hegi, l. c. f. 1886; Bot. Mag. XLIV, 1893. — Exs.: G.R.F. No. 1713.

Strongly spinose, rigid, nearly leafless shrubs, up to 2(3) m high; branches angularly flexuose, the juvenile with cinammon-brown hairs, the adult glabrous, red-brown, often with scarious-peeling bark; leaves obliquely ovate, obtuse or short-acuminate, rounded or slightly cordate at base, 2-4 cm long, 1.3-3 cm wide, obscurely denticulate to entire, thick, coriaceous, grayish-green above, glabrous, shiny, paler beneath, often faintly pubescent along nerves, with petioles up to 1 cm long. Flowers stellate, ca. 3-4 mm in diameter; fruit 1.3 to 2.8 cm in diameter, pale yellow to red-brown. Fl. May, beginning of June, Fr. from July. (Plate XXXIV, Figure 2.)

Dry, clayey, gravelly and stony, sunny slopes of hills and mountains up to 1,500 m, often forming impassable undergrowths, also growing together with other xerophyllous shrubs. — European part: Crim.; Caucasus: all regions; Centr. Asia: Mtn. Turkm., Pam.-Al. **Gen. distr.:** Centr. Eur. (S.), Med., Bal.-As. Min., Arm.-Kurd., Iran. Described from Europe. Type in London.

Economic importance. An ornamental shrub providing excellent material for hedges, especially in fruit. In former times the root and leaves were used as diuretics. The fruits and the bark contain tannin.

* *Paliuros* — Theophrastus' name for the shrub; probably from the Greek *palein* — move and *uron* — urine, because of the plant's diuretic properties.

Genus 874. **ZIZYPHUS*** Mill.

Mill. Gard. Dict. ed. 8 (1768)

637 Calyx saucer-shaped, with broadly triangular spreading keeled lobes; petals small, broadly spoon-shaped, embracing stamens; styles usually 2-, rarely 3-partite; ovary usually 2-, rarely 3-4-locular; fruit drupaceous, with succulent fleshy mesocarp, stone 2-, 1- and 3-seeded; seeds smooth, not furrowed.

Shrubs or trees; leaves alternate, nearly biseriate, coriaceous, 3-nerved, with 1 pair of prickly persistent stipules at base, one of which erect, obliquely antrorse, the other recurved; inflorescences axillary, cymose.

About 50 species in the tropical and subtropical zones of the Old and New World.

Abundant findings of the genus *Zizyphus* in deposits up to Miocene (Sarmatian).

Zizyphus affinis Lesq. in Upper Cretaceous Tsagayan Amur (Bureya Tsagayan).— *Z. cinnamomoides* Lesq. in Upper Oligocene Sakh. (Cape Rogatyi).— *Z. fibrillosa* Lesq. in Upper Cretaceous Amur (tunnel 147 C.).— *Z. fothergilloides* Krysht. in Upper Cretaceous Ze.-Bu. (Chekundinka).— *Z. hyperborea* Heer in Upper Cretaceous Tsagayan Amur (Bureya Tsagayan).— *Z. kolymensis* Krysht. in Upper Cretaceous Lena-Kol. (Vetrechnaya).— *Z. matutina* Krysht. in Paleocene Amur (Raichikha).— *Z. phorphoria* Krysht. in Upper Cretaceous Ze.-Bu. (Arkharu, Bureya Tsagayan).— *Z. sachalinensis* Krysht. in Oligocene Sakh. (Pyatyi Klyuch in Pil'vo).— *Z. tiliaefolia* (Ung.) Heer in Oligocene Ar.-Casp. (Dzhar-Kue, Kara-Sandyk); in Paleocene Amur (Raichikha); Sarmatian Transcarpathians (Mukachevo, Uzhgorod), Bl. (Krynka); and in Miocene Uss. (Suifun).— *Zizyphus* sp. in Oligocene Uss. (Rechnoi Peninsula), Balkh. (Ashutas); and Upper Cretaceous Lena-Kol. (Silyan, Vstrechnaya rivers).

1. *Z. jujuba*** Mill. Gard. Dict. ed. 8 (1768) non Lam. (1789).— *Rhamnus zizyphus* L. Sp. pl. (1753) 194; Pall. Fl. Ross. II, 24.— *Zizyphus sativa* Gaertn. De Fruct. I (1788) 202; B. Fedch., Rast. Turk. 566.— *Z. vulgaris* Lam. Tabl. Encycl. III. II (1793) 330; DC. Prodr. II, 19; Boiss. Fl. or. II, 12; Ldb. Fl. Ross. I, 501; Maxim. Rhamn. or.-as. 3; Ej. Enum. pl. Mong. 156; Grossg., Fl. Kavk. III, 50.— *Z. sinensis* Lam. Encycl. III (1789) 317.— Ic.: Pall. l. c. tab. 59.— Exs.: G. R. F. No. 1917.

Shrubs (tree); spreading-branching spinose plants (cultivated form — var. *inermis* Bge. — woody, without prickles), up to 3(6–8) m high; branches angularly flexuose, glabrous, red-brown, with paired large acute prickles at "angles" up to 3 cm long, and with thin erect greenish biseriately leafy shoots (1–3 on each) like a compound leaf; leaves coriaceous, glabrous, dark green above, shiny, obliquely oblong-ovate to broadly lanceolate, usually obtuse, rounded or slightly cordate at base, obtusely and finely dentate, short-petiolate or subsessile, with small stipules at base. Flowers

* From the Greek *Zizyphos* or *zizipha* — the ancient Greek name for the plant.

** *Jubus* — the name given the fruits of this plant by Avicenna.



PLATE XXXIV. 1 - *Sageretia laetevirens* (Kom.) Gontsch., part of branch with fruits and flowers; 1a - flowers; 2 - *Paliurus spina christi* Mill., branch with fruits; 2a - inflorescence; 3 - *Zizyphus jujuba* Mill., part of flowering branch; 3a - fruit, 3b - flower.

stellate, 3–4 mm in diameter, in dense glomerules on very short peduncles; fruit globose, 1–1.5 cm long (in cultivated forms up to 3 cm long, often oblong-oval), to dark cinnamon, shiny. Fl. June–July, Fr. from August. (Plate XXXIV, Figure 3.)

- 638 Dry, gravelly or stony sunny slopes of hills and mountains up to 1,500 m.—Caucasus: W., E. and S. Transc.; Centr. Asia: Kara K., Mtn. Turkm., Syr. D., Pam.-Al., T. Sh. (S.), Dzu.-Tarb. Gen. distr.: Med., Bal.-As. Min. Arm.-Kurd., Iran., Ind.-Him., Dzu.-Kash., Mong., Jap.-Ch., Tib. Described from Europe. Type in London.

Economic importance. The fruits contain sugar that is both nutritious and tasty. Since ancient times the plant has been cultivated in gardens throughout its entire distribution area, especially in the East where there are several cultivated strains. Up to the end of the 19th century it was highly valued in Europe in medicine where the fruits (*Baccae jujubae*, jujube, Brustbeere — breast berry) and preparations made from them were used as emollients in the treatment of throat and catarrhal infections. The bark contains tannin. The wood is dense and is used for turning.

Tribe 2. **RHAMNEAE** Benth. et Hook. Gen. pl. I (1862) 373. — Fruit drupaceous, with fleshy mesocarp and compound kernel, usually separate into 2–3–4-thin-walled "stones" (cells); flowers bisexual or unisexual, in dioecious plants, 4–5-merous; ovary superior or semiinferior, usually free; disk thin, lining calyx tube; leaves pinnately veined, with small herbaceous deciduous stipules at base.

Genus 875. **SAGERETIA*** Brongn.

Brongn. in Ann. Sc. Nat. X (1827) 359, tab. 13, f. 2

Flowers small, 5-merous, sessile, in clusters arranged in long spiciform inflorescences terminal on branches; calyx poculiform, with broadly triangular lobes; petals small, hooded, with narrow very short claws, enclosing stamens; styles thick, bearing 3-lobed stigma; ovary free, buried in disk, 3-locular; fruit with "stones" dehiscent at inner suture; seeds smooth, not furrowed.

Shrubs, with nearly opposite branches and leaves; seeds dispersed by birds. More than 20 species mainly in the subtropical zones of Asia, N. Africa and C. America.

The genus *Sageretia* was found only once, in the Caucasus. — *Sageretia caucasica* Palib. in Oligocene W. Transc. (Goderzi).

- 641 *S. laetevirens* (Kom.) Gontsch. in Tr. Bot. Inst. AN SSSR, ser. 1, IV (1937) 269. — *S. brandrethiana* Boiss. Fl. or. II (1872) 22 et Suppl. 158, non Aitch.; B. Fedch., Rast. Turk. 566; Lipskii, Mater. dlya Fl. Sr. Azii, III, 10, non Aitch. — *Rhamnus laetevirens* Kom. in Tr. SPb. Obshch. estestv. XXVI (1896) 162. — Exs.: Aitch. No. 759 (sub *Sageretia* sp.), Bornmüller, No. 3430 (sub *S. brandrethiana* Aitch.).

* In honor of Sageret, president of the Paris Agricultural Society.

Small shrubs up to 1.5 m high, robust, strongly spinose, with erect short branches, usually turning into large erect spines, bark pale brown, cinnamon or gray, often tomentose when young; leaves polymorphic, thin- or thick- coriaceous, bright or dark green, the adult glabrous, shiny, the juvenile usually pubescent or even loosely gray-tomentose beneath, small, 0.5–1.5(2) cm long, 0.3–1 cm wide, broadly lanceolate to oval, rounded, obtuse or even faintly emarginate at apex, sometimes short-acuminate, rounded or slightly cordate at base, subsessile or with very short (rarely up to 5 mm) petioles. Flowers small, ca. 1.5–2 mm in diameter, dark yellow or reddish, sessile, in clusters forming spikes at ends of leafy branches; fruit pyriform-triangular, 5–7 mm long, baccate, black, with small layer of succulent meso- carp or often nearly dry, coriaceous, cinnamon-brown, with 3 "stones"; seeds oblong-ovoid, trihedral, smooth, shiny, not furrowed, ca. 5 mm long, light brown or yellow, in firm cartilaginous coat (endocarp). Fl. April-June; Fr. June-August (September). (Plate XXXIV, Figure 1.)

In southern slopes, mainly limestone, stony or rocky, 500 to 2,700 m. – Centr. Asia: Pam.-Al. (W.). **Gen. distr.:** Iran. Described from Zeravshan. Type in Leningrad.

Economic importance. The fruits are sweet – popular in Afghanistan. **Note.** Closely related to the Russian *S. brandrethiana* Aitch., *S. laetevirens* is distributed in the mountains of NW India and easily distinguished from the former by darker and thicker leaves, more densely white-tomentose beneath. Another related species, *S. yemensis* (Defl.) Grub., occurs in Arabia and NE Africa.

Genus 876. **FRANGULA** * Mill.
Mill. Gard. Dict. ed. 7 (1759)

Flowers in axillary forked cymes or fascicles, bisexual, 5-merous; calyx campanulate, fleshy, with ovate-triangular erect lobes; petals clawed, short, wide, embracing stamens; styles simple, with 3-lobed stigma; ovary 3-locular; fruit succulent, drupaceous, with 3 loosely adhering "stones"; seeds lenticular, with cartilaginous beak, not furrowed; embryo with thick inflated cotyledons not emerging on germination from thin compact seed coat (endocarp).

Shrubs or small trees, with alternate, unarmed branches; buds glabrous naked; leaves with pinnately parallel nerves. Seeds dispersed by birds. Principally an American and subtropical genus of about 50 species.

- 642
- | | | |
|----|--|---|
| 1. | Leaves dentate; flowers in forked cymes on long peduncles | 2. |
| + | Leaves entire; flowers in axillary fascicles | 1. <i>F. alnus</i> Mill. |
| 2. | Leaves thin, chartaceous, up to 20 cm long, with 11–14 pairs of lateral nerves; tall forest shrubs | 2. <i>F. grandifolia</i> (F. et M.) Grub. |
| + | Leaves semi-coriaceous, up to 6 cm long, with 7–10 pairs of lateral nerves; crooked-growing rocky shrubs | |
| | | 3. <i>F. rupestris</i> (Scop.) Schur. |

* The generic name by Mattioli and Dodoneus; from the Latin *frangere* – to break, because of the brittleness of the wood.

Section 1. EUFRANGULA Grub.— Flowers in axillary fascicles; leaves entire.

1. *F. alnus* Miller, Gard. Dict. ed. 8 (1768); Hegi, Ill. Fl. V, 1, 344, f. 1900.— *F. pentapetala* Gilib. Exercit. I (1792) 280.— *F. vulgaris* Rchb. Fl. Germ. Excurs. (1832) 488.— *Rhamnus frangula* L. Sp. pl. (1753) 193; DC. Prodr. II, 26; Ldb. Fl. Ross. I, 503; Shmal'g., Fl. I, 205; Kryl., Fl. Zap. Sib. VIII, 1890; B. Fedch., Rast. Turk. 567.— *Rh. sanguinea* Pers. Syn. pl. I (1805) 239; DC. Prodr. II, 26.— Ic.: Schlechtendal, Fl. v. Deutschl. XXI, tab. 2189; Hegi, l. c. tab. 181, f. 1 et 4e.— Exs.: G. R. F. No. 108.

Shrubs or trees, up to 7 m high, with smooth nearly black bark; branches annual, thin, red-brown, with lanceolate white lenticels; shoots glabrous or brownish-hairy; buds brown silky-hairy; leaves thick-chartaceous, dark [?] green, slightly glossy, glabrous, yellowish-green above, glabrous or with rufous hairs along nerves beneath, oblong-elliptic to broadly ovate, 3–8 cm long, 1.5–4.5 cm wide, rarely up to 12 cm long and 6 cm wide (var. *latifolia* (Dipp.) Grub. = *Rh. fr.* var. *orientalis* Somm. et Lev. = *Rh. fr.* var. *abhasica* Pastern.), abruptly short-cuspidate or rounded, usually cuneate at base, entire, with 7–10 pairs of slightly curved nerves; petioles up to 1.5 cm long. Flowers 2–7 in axils of leaves, narrowly campanulate, 2.5–3.5 mm long, yellowish outside, glabrous or short-hairy, inside yellow, glabrous, on pedicels ca. 1 cm long; fruit globose, ca. 8 (rarely up to 10) mm in diameter, at first raspberry red, later violet-black; "stones" 3, triangular-lenticular, ca. 5 mm long, smooth, brown, with narrow beak. Fl. end of April, beginning of July, again August–September, Fr. August–September.

- 643 Edges of undergrowth, groves, shrubby formations along banks of rivers and lakes, margins of swamps, flooded and swampy meadows, also occurring on dry clayey and gravelly slopes; in mountains up to 2,000 m. In Europe it reaches 66° 40' N in the north (Jokkmokk, Sweden); the extreme northern locality in the USSR (66° 30') is Chupa station on the White Sea coast. In the south it reaches 36° N (S. Apennines and Gilan province in Iran).— European part: all regions; Caucasus: all regions; W. Siberia: Ob, U. Tob., Irt., Alt.; E. Siberia: Ang.-Say. (Krasnoyarsk, Minusinsk); Centr. Asia: Ar.-Casp., Balkh., Dzu.-Tarb. Gen. distr.: Scand., Centr. Eur., Atl. Eur., Med., Bal.-As. Min., Iran. (Gilan), Dzu.-Kash. (N.). Described from Europe. Type in London.

Economic importance. The bark (*Cortex Frangulae*) was used in Europe up to the beginning of the 20th century for its purgative and emetic properties. The boiled bark and ripe fruits are regarded in all European countries as an excellent and quick-acting means of treating liver ailments, dropsy, fever, intestinal worms. Externally, the decoction is used as a lotion against rash. The bark and unripe fruits yield a yellow dye. Dyes obtained from the ripe fruits stain cottons green and woollens violet. The timber is soft, pale orange and yields a nearly ash-free carbon of excellent quality used in the manufacture of first-class gunpowder. It is also used in the production of plywood, shoe lasts and pegs. An ornamental plant.

Section 2. CASCARA Grub.— Flowers numerous, in simple or compound forked cymes on well-developed long peduncles and usually with large foliaceous bracts; leaves dentate at margin.

2. *F. grandifolia* (Fisch. et Mey.) Grub. comb. nova.— *Rhamnus grandifolius* F. et M. in Hohenack. Enum. pl. Talysh. (1837) 99; Ldb. Fl. Ross. I, 504; Boiss. Fl. or. II, 22 excl. var. β . *brachypus*; Medv., Der. i kust. Kavk. (1919) 67; Grossg., Fl. Kavk. III, 53; C. K. Schneid. Laubholz. II, 265.— Ic.: Bull. Ac. Sc. St.-Petersb. XXXIV (1892) 418 Dipp. Handb. Laubh. f. 254.

Diffuse shrubs up to 5(6) m high, with dark gray or nearly black bark; branches brown or yellowish-gray, with dark red-brown lenticels, glabrous; shoots olive-green, brownish-velutinous; buds large, silky-hairy; leaves thin, chartaceous, dark green above, dull, glabrous, paler beneath, yellowish, sparingly hairy, elliptic or broadly elliptic, symmetrical, (7)10–18 cm long, (4)6–10 cm wide, often widest in upper half, broadly triangular towards apex, attenuate-mucronate or short-acuminate, at base rounded or slightly cordate, irregularly serrulate at margin, often dentate at apex, nerves 11–14 pairs, brown appressed-hairy, almost straight, parallel; petioles short, 1–2 cm long, thick. Inflorescences umbelliform, on long peduncles up to 6 cm long, 6–12-flowered; pedicels hairy, ca. 1 cm long; flowers broadly campanulate, pubescent, greenish-yellow, 3–4 mm long; ripe fruit violet-black, globose, 6–8 mm in diameter, with 3 lenticular dark brown "stones" with broad yellow beak. Fl. end of April–June, Fr. July–August. (Plate XXXV, Figure 5.)

Edges and underwood of broadleaved forests in the lower mountain belt up to 500 m.— Caucasus: E. Transc. (Kuba district), Tal. Gen. distr.: Iran. (Gilan). Endemic. Described from Talysh. Type in Leningrad.

Economic importance. This species is closely related to the American *F. purshiana* Coop. from whose bark Cascara sagrada is obtained. It is possible that the bark of *F. grandifolia* also has similar properties. An ornamental shrub.

Note. Until recently this species was confused with *Rhamnus imeretina* Booth., resulting in incorrect descriptions and reports of its distribution (Medvedev, Boissier). The Pallas plants, cited by Ledebour, apparently refer to *R. imeretina* Booth. (see Note) and the Gmelin to *R. sintenisii* Rchb. f. (the error is Ledebour's). Gleditsch's report that there is a specimen of the original *P. grandifolia* in the Botanical Institute of the Academy of Sciences of the USSR with a label showing its origin from the former Rachin district in Georgia ("inter fruteta montana prope Ceva d. 9 Julii 1774, it. pr. Tschkmeri"), is highly questionable. It is more likely that in the process of mounting, the wrong label was attached and as such arrived at the Pallas herbarium.

3. *F. rupestris* (Scop.) Schur, Enum. pl. Transsilv. (1865) 142.— *F. wulfenii* Rchb. Fl. Germ. excurs. (1832) 488.— *Rhamnus rupestris* Scop. Fl. Carniol. ed. 2, I (1772) 164, tab. 5; Boiss. Fl. or. II, 21; Brandza, Pr. Fl. Romane, 208.— *Rh. pumilus* Wulf. in Jacq. Collect. II (1788) 141, tab. II, non L. nec Turra.— *Rh. pumilus* ϵ . *wulfenii* DC. Prodr. II (1825) 25, non L.— *Rh. wulfenii* Hoppe in Flora, VI (1823) 174; Spreng. Syst. I (1825) 768, non Roth.—

Rh. rumeliaca Friwald. in *Flora*, XVIII (1835) 332. — Ic.: Schlechtend. *Fl. v. Deutschl.* tab. 2189; Hegi, *Ill. Fl. V*, 1, 349, f. 1903. — Exs.: *Fl. exs. austro-hung.* No. 3222.

645 Prostrate shrubs, with crooked, strongly branching stem up to 1 m high; branches dark gray or brown, nodose, with inconspicuous lenticels; shoots light brown, short-hairy; buds silky-hairy; leaves thick-chartaceous or subcoriaceous, bright green, dull above and pale green, with brownish appressed hairs only along nerves beneath, broadly oval or broadly obovate to oblong-oval, 1.5–5(6) cm long, 1–4 cm wide, short-acuminate or obtuse at apex, rounded or slightly cordate at base, crenate-serrate (especially at apex) to entire, with 7–10 pairs of slightly curved nerves strongly protruding below; petioles up to 7 mm long, thick, pubescent. Cymes forked, compound, 2–10-flowered, with 1–2 bracts, on long, up to 4 cm peduncles; flowers poculiform, 2.5–3 mm long, outside pale green or yellowish, inside yellow, glabrous or short-hairy, on pedicels up to 1 cm long; fruit ca. 6–7 mm in diameter, at first red, later violet-black, with 3 dark brown, oval-lenticular "stones" with yellow cartilaginous beak. *Fl.* May–June, *Fr.* August–September. (Plate XXXV, Figure 4.)

Limestone, stony and rocky sunny slopes, walls of ravines, banks of mountain streams, from bottom of mountains up to 1,500 m. — European part: U. Dns. (reported from the Carpathians). **Gen. distr.:** Bal. Described from Gorica.

Note 1. The priority of the correct name of this species in Hegi, l. c. and *Fl. Ital. exs. ser. II*, No. 1893 is unjustifiably attributed to Brogniart.

Note 2. Reports in the old literature on the presence of *R. alpina* L. in Bukovina were never confirmed by botanists working in this region. It should probably be referred to *F. rupestris*.

Genus 877. **RHAMNUS** * L.

L. Sp. pl. ed. 1 (1753) 193, p. p.

Flowers fascicled in axils of leaves or (rarely) in racemiform inflorescences, usually in dioecious plants, 4-, rarely 5-merous; calyx infundibular-campanulate, with triangular lobes; petals very small, narrowly clawed, embracing stamens or often completely absent; styles 2–3-partite; ovary 2–3- (rarely 4-) locular; fruit succulent, drupaceous, with 2–3(4) "stones"; seeds oval, slightly compressed or globulose-trihedral, with dorsal or lateral furrow, cotyledons thin, horseshoe-shaped, curved, protruding from the thin cartilaginous coat (endocarp) and opening towards inner suture. Shrubs or small trees, with nearly opposite (and usually spinose) or alternate branches and leaves; buds with well developed scales; seeds dispersed by birds. Large (more than 150 species described so far) central genus of the family, with its widest variability and most of the species in E. Asia.

645 **Economic importance.** An unfairly neglected genus that has been quite popular as a dye plant. "Chinese green" or "lokao" (obtained from the bark of *R. utilis* Dene. and *R. globosa* Bge.), dye grains (dried fruits) — "Avignon" (*R. infectoria* L. and *R. saxatilis* Jacq. —

* A name used by Dioscorides and Theophrastus; from the Greek *ramnon* — prickly, spine?

"Graines d'Avignon"), "Persian" (*R. petiolaris* Boiss.), "Hungarian" (*R. tinctoria* W. et K.) and "aquarelle green" ("Vert de vessie") were in wide demand (especially in France) as excellent natural dyes in the textile industry (primarily), leather and haberdashery, paper manufacture, and painting. The exquisite color, purity of hue, iridescence and "play" of Chinese silk dyed Chinese green indigo so attracted the Europeans in the 19th century that representatives of factories, missionaries and consuls undertook special missions to discover the composition of the dyes and methods of dyeing, efforts which were highly successful. Two shrubs from which lokao was obtained were found and sent to Europe, and thus the secret of dyeing fabrics was disclosed. In 1875, the French botanist Academician Decaisne informed the Paris Academy of these valuable plants which he had scientifically described (*R. utilis* Dcne. and *R. chlorophorus* Dcne. = *R. globosa* Bge.). It was at this time that the plants were introduced into cultivation in many European countries. Many works by chemists, pharmacists and botanists were devoted to studying these plants (see, for example, the special collection Rondot "Vert de Chine"). This stimulated extensive investigation of local European, already used species of this genus and discovery of many of their valuable qualities.

All the species of *Rhamnus* contain dye substances (mainly rhamnetin, quercitin and rhamnazin), but taken separately each species has its own peculiarities, yields its own typical hue. The color and its intensity depend upon what part of the plant is used as dyeing material, at what period of growth it is collected and in what state it is used. Thus, the unripe fruits of *R. cathartica* yield a yellow color, the ripe ones an emerald green, the known aquarelle "vegetative" green, and the over-ripe a purple-red; the fresh bark yields a bright yellow color, the dry a cinnamon brown. With the use of the corresponding mordants (alum, copper and iron vitriols, tin dioxide, chromium, etc.) it is possible to obtain virtually the entire spectrum of colors from lemon-yellow to purple and dark cinnamon-brown, from olive-green to intensive blue and violet. For example, the bark of *R. cathartica* L. as a mordant with alum yields a red color, with iron vitriol a black one.

Although the attempts with the European species (*R. cathartica* L., *R. saxatilis* L., *R. tinctoria* W. et K., *R. alaternus* L., and others) to dye fabrics in the "Chinese manner" failed to produce the iridescence and play of material which the Chinese achieved with lokao, it should be noted that these species (at least *R. cathartica* L.) contain the same light-sensitive (the effect of light intensifying the dye) and fluorescent dye properties as the Chinese species.

647 The European species also possess another valuable quality — they yield a beautiful "smoky" hue to silks and cottons and are therefore often added to other natural and artificial dyes.

The dye extracts obtained from the bark, leaves and fruits are suitable for dyeing cottons, silks, woollens, leather, paper and wood. These dyes are exceptional for their fastness.

In addition the bark (especially that of *R. cathartica* L.) is rich in tannin and as such might be of interest as a tanning agent.

In view of the enumerated qualities, the species of this genus deserve serious attention as raw materials for local light industry. The shrubs usually occur in thickets, profusely fruit-bearing, and easily reproduced. Consequently, the preparation of raw material is fairly simple.

The Russian species most promising for practical use are *R. cathartica* L. and *R. dolichophylla* Gontsch., *R. dahurica* Pall. and *R. ussuriensis* J. Vass. (very close to the Chinese *R. utilis* Dcne.) and *R. diamantiaca* Nakai (related to *R. globosa* Bge.), *R. imeretina* Booth in the Caucasus and *R. pallasii* F. et M., *R. coriacea* Kom., *R. sintenisii* Rech. f. and the other species of this series (close to the Mediterranean *R. oleoides* L.) in the Caucasus and Central Asia.

The seeds are rich in fatty oil. All species are good nectar plants and most of them are ornamental. However, although *R. cathartica* L. and *R. dahurica* Pall. s. l. are the main intermediate (host) plants for *Puccinia coronifera* Kleb., their utilization for these purposes on farms is not desirable. For the medicinal value, see description of *R. cathartica* L.

The genus *Rhamnus* is reported for the USSR from the Paleocene to the Quaternary but not all findings are reliable.

Rhamnus acuminatifolia O. Web. (?) in Oligocene Uss. (Pos'et).—*R. aizoon* Heer in Sarmatian Transcarpathians (Berezinka).—*R. brevifolia* A. Br. in Sarmatian Bl. (Amvrosievka).—*R. cathartica* L. in Interglacial U. V. (Likhvin); Postglacial tuffs in Cisc. (Zheleznaya near Zheleznovodsk).—*R. dechenii* O. Web. in Oligocene W. Transc. (Goderzi).—*R. deleta* Heer in Sarmatian Transcarpathians (Berezinka, Mukachevo, Uzhgorod).—*R. eridani* Ung. in Oligocene V.-Don (Tim).—*R. duensis* Heer in Eocene Sakh. (Due River).—*R. eocaenica* Bors. in Eocene Due Sakh. (Ogorodnaya pad').—*R. gaudinii* Heer in Oligocene W. Transc. (Goderzi), Uss. (Rechnoi Peninsula); in Sarmatian Transcarpathian (Berezinka).—*R. graeffii* Heer in Lower Miocene Transv. (Tashlair, Sterlitam).—*R. cf. inaequalis* Heer in Oligocene Uss. (Pos'et).—*R. pseudogoldiana* Hollick in Oligocene Sakh. (Ozernaya).—*R. punctata* Heer in Oligocene Uss. (Rechnoi Peninsula) and Sakh. (Mgachi).—*R. rectinervis* Heer in Paleocene L. Don (Kamyshin, Ushi); 648 in Oligocene V.-Don (Tim), W. Transc. (Goderzi), Uss. (Amagu).—*R. cf. rectinervis* Heer in Paleocene Amur (Raichikha); in Sarmatian Transcarpathians (Keral-Sek).—*Rhamniphyllum ussuriense* Krysh. in Miocene Uss. (Suifun district).

1. Evergreen shrubs, with thick-coriaceous rigid and usually spinose-dentate leaves* and spike-like inflorescences 1. *R. alaternus* L.
- + Leaves deciduous, not as above; flowers in fascicles 2.
2. Leaves broad, with numerous (rarely less than 7 pairs) nearly straight, parallel nerves; unarmed shrubs 3.
- + Leaves with few (up to 6 pairs) arcuate lateral nerves; plants more or less armed 5.
3. Leaves very large (up to 25 cm long), with 15–25 pairs of lateral nerves, velutinous with gray or bronze hairs beneath 2. *R. imeretina* Booth.
- + Leaves not as large (up to 7 cm long), glabrous or sparingly pubescent, with less than 10 pairs of nerves 4.

* In the Key and descriptions of the species, the developed summer leaves of the mature branches are implied.

4. Leaves broadly oval or orbicular, often cordate at base, not less than 2.5 cm long, with 7–10 pairs of nerves, without persistent stipules 3. *R. microcarpa* Boiss.
- + Leaves elliptic, never cordate, up to 2 cm long, with 5–7 pairs of nerves and long-persistent subulate stipules 4. *R. depressa* Grub.
5. Leaves large, broadly oval to elliptic, usually more than 1 cm wide, with 2–6 pairs of lateral nerves; seeds with lateral or dorsal not forked furrow (without appendage) 6.
- + Leaves narrow, linear-lanceolate to spatulate, rarely elliptic, if oval or orbicular, then small (up to 1 cm long), rarely more than 1 cm wide, always with 4 pairs of lateral nerves; seeds with dorsal furrow forked at upper end (with appendage) 12.
6. Leaves usually thin, large, 5–12 cm long; seeds unrimmed, with thin not splitting testa and with slit-like lateral furrow for their entire length 7.
- + Leaves usually thick, often coriaceous, smaller; seeds with firm, cartilaginous testa splitting after ripening of fruit, and with rimmed dorsal furrow 9.
7. Leaves with 4–6 pairs of lateral nerves; fruit usually with 2 "stones;" seeds plano-inflated, obtuse 8.
- + Leaves with 3 pairs of strong lateral nerves arcuate and converging at apex; fruit usually with 3–4 "stones;" seeds suborbicular at cross section, slightly faceted, ovate, with acute cartilaginous beak 7. *R. cathartica* L.
8. Trees up to 10 m tall, rarely large shrubs, with branches terminated by large bud; leaves oval, 3–5 cm wide, with 4(6) nerves arcuate and converging at apex 5. *R. dahurica* Pall.
- + Shrubs up to 5 m high, with virgate branches terminated by a spine; leaves narrower, dimorphic, large, oblong, with 5–6 pairs of sharply curved nerves, leaves on juvenile shoots smaller, obovate, oval on the reduced fertile branches 6. *R. ussuriensis* J. Vass.
9. Leaves thick, oblong, with 4–6 pairs of lateral nerves, with long (1.5–3 cm) petioles; fruit large, ca. 7 mm in diameter, succulent; seeds with broadly open dorsal furrow; trees up to 6 m tall (Centr. Asia) 10. *R. dolichophylla* Gontsch.
- + Leaves with 2–4 pairs of nerves, oval, with short petioles (rarely longer than 1.5 cm); fruit smaller, usually dryish, divided; shrubs 10.
10. Leaves with 2–3 pairs of lateral nerves arcuate and converging at apex, long persistent, nearly as long as petioles; stipules persistent; seeds with dorsal open furrow, not compressed, with pale dorsal and apical planes; loose shrubs, with thin drooping branches (Moldavia) 11. *R. tinctoria* W. et K.
- + Leaves usually with 4 pairs of nerves and short deciduous stipules; seeds compressed, with lateral slit (Far East) 11.
11. Leaves 2.5–6 cm long, petioles 1–1.5 cm long; seeds large, dark brown or black-brown, with closed slit for nearly the entire length, open only at lower end, cartilaginous-rimmed; large forest shrubs 8. *R. diamantiaca* Nakai.

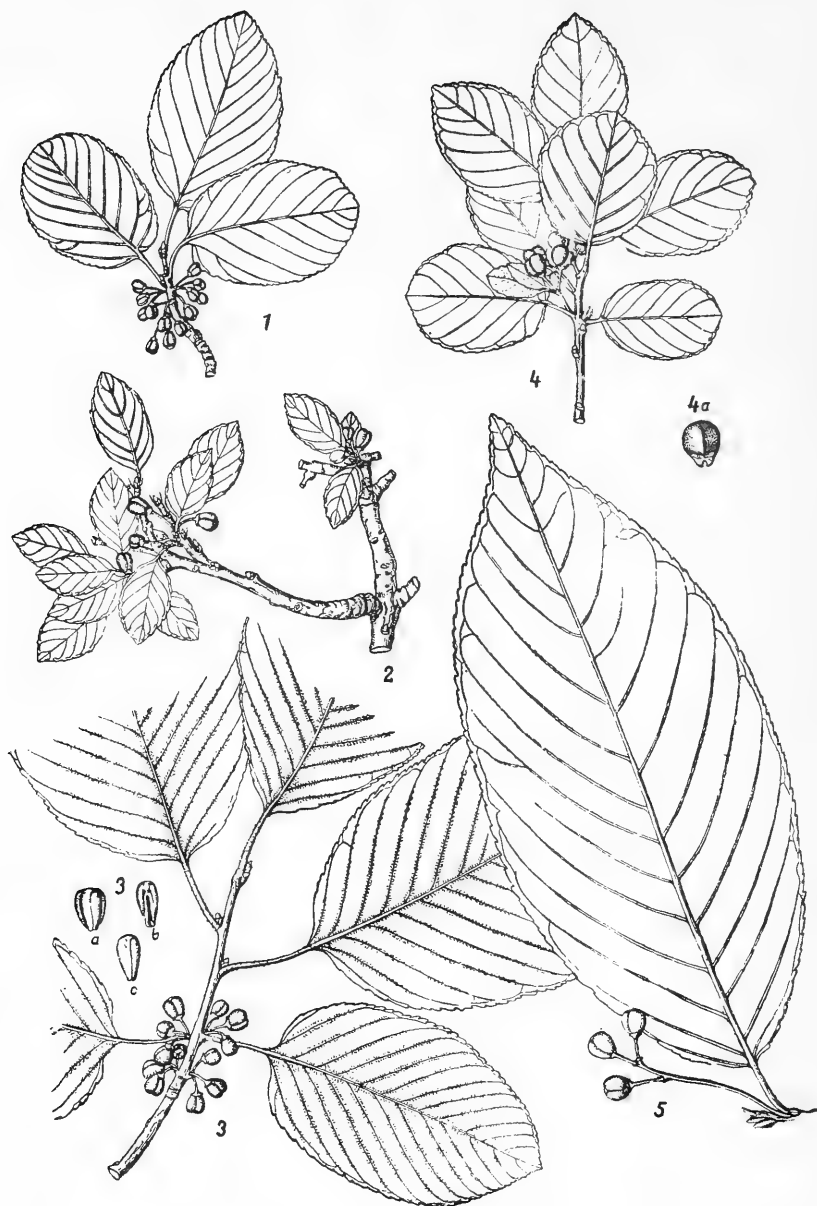


PLATE XXXV. 1 - *Rhamnus microcarpa* Boiss., branch with fruits; 2 - *Rh. depressa* Grub., branch with fruits; 3 - *Rh. imeretina* Booth., branch with fruits; 3a - seeds in open testa ("stone"), 3b - seeds from dorsal side, 3c - seeds from ventral side; 4 - *Frangula rupestris* Schur., branch with fruits; 4a - "stone"; 5 - *F. grandifolia* (F. et M.) Grub., end of branch with fruits.

- 652
- + Leaves 1.5–2.5 cm long, petioles short (rarely up to 1 cm); seeds usually paler, olive-brown, with open rimmed furrow for $\frac{3}{4}$ of their length; rigid, small xerophyllous shrubs 9. *R. parvifolia* Bge.
 - 12. Leaves 3–9 cm long, thick-chartaceous, denticulate or serrate, usually linear-lanceolate or lanceolate 13.
 - + Leaves small, rarely more than 3 cm long, coriaceous, denticulate to entire, usually broadly spatulate, lanceolate or oval 15.
 - 13. Leaves lanceolate or elliptic, 2.5–7 cm long, 0.8–2 cm wide, habit and seeds intermediate between *R. cathartica* and *R. pallasii* 14. *R. spathulifolia* F. et M.
 - + Leaves not more than 1 cm wide; seeds typical (see No. 5 of Key) 14.
 - 14. Leaves 5–8 cm long, linear-lanceolate to linear, evenly tapering from middle towards both ends; seeds obliquely ovoid, dull, with broad deep furrow (E. Siberia) 12. *R. erythroxyton* Pall.
 - + Leaves linear, spatulate-linear or linear-lanceolate, rarely narrowly spatulate, widest in upper third, 3–5 cm long; seeds symmetrical, shiny, with shallow furrow (Caucasus) 13. *R. pallasii* F. et M.
 - 15. Leaves always entire, 1.5–2.5 cm long, 6–10 mm wide (E. T. Sh.) 19. *R. songorica* Gontsch.
 - + Leaves usually dentate, smaller 16.
 - 16. Very small, procumbent shrubs, 10–25 cm high; leaves very small, 5–10 mm long, oval, thin; seeds plano-convex, with furrow along their entire width (Pamir) 18. *R. minuta* Grub.
 - + Larger shrubs; leaves larger, coarse 17.
 - 17. Leaves lanceolate or narrowly lanceolate, 1.5–2.5 cm long, usually pubescent; seeds generally pale yellow, plano-convex, with furrow along their entire width, parted above by small appendage (Bukhara) 17. *R. baldschuanica* Grub.
 - + Leaves spatulate to orbicular, 1–2 cm long, rarely lanceolate; seeds orbicular at cross section, with narrow furrow parted above by well-developed appendage 18.
 - 18. Leaves thick-coriaceous, broadly spatulate or oval, 1–1.5 cm long, 0.5–1 cm wide, often acutely dentate at margin, with distinct lateral nerves; furrow of seed with simple appendage 16. *R. coriacea* Kom.
 - + Leaves thinner, spatulate or lanceolate, 1.5–2 cm long, 4–5 cm wide, glandular-serrate or crenate at margin, with inconspicuous lateral nerves; furrow of seed with developed appendage, often forked at end (with "bridle") 15. *R. sintenisii* Rech. f.

Section 1. ALATERNUS DC. Prodr. II (1825) 23. — Flowers in axillary racemiform or paniculate inflorescences in dioecious plants, 5-merous, apetalous; style 3-partite; ovary 3-locular; fruit with 3 "stones;" seeds globulose-triangular, with rimmed dorsal furrow deep in the firm testa dehiscing after ripening. Evergreen, unarmed shrubs, with alternate, thick-coriaceous leaves.

Series 1. *Alaternae* Grub. — Racemes dense, spike-like, with thickened rhachis, sometimes slightly branching. Shrubs of the Mediterranean coast and islands (*R. balearica* Willk., *R. tripolitana* Engl., *R. myrtifolia* Willk. and the described species).

1. *R. alaternus* L. Sp. pl. ed. 1 (1753) 193; DC. Prodr. II, 23, excl. var. α . *balearicus* et β . *hispanicus*; Boiss. Fl. or. II, 14; Shmal'g., Fl. I, 205; C.K. Schn. Laubholz. II, 270. — *Rh. clusii* Willd. Enum. Hort. Berol. (1809) 250. — Ic.: Schn. l. c. f. 187, a–f; f. 188, g–n; Hegi, Ill. Fl. VI, f. 1888.

Evergreen diffuse shrubs, up to 5 m high, with red- or gray-brown branches and olive-green shoots; leaves thick-coriaceous, glabrous, dark green, shiny above, light green or bronze-yellow beneath, very variable in shape but usually oval, broadly elliptic or obovate, or, often, lanceolate (var. *angustifolia* Willd.), generally asymmetrical, angular, 2.5–5 cm long, 1–3 cm wide, short-acuminate, obtuse, rounded or sometimes slightly emarginate with short prickles at apex, broadly cuneate or rounded at base, prickly-dentate at the cartilaginous margin, rarely entire, with broad midrib protruding beneath and 3–4 pairs of thin lateral nerves, the lower pair stronger, parallel to base of leaves; petioles short, thick. Flowers usually 5-merous, campanulate, ca. 4 mm long, yellow-green, in simple, rarely slightly branching, racemiform inflorescences; fruit obovoid, divided or globose, 5 mm long, with thin layer of pulp, red at first, later black, "stones" 3, testa densely cartilaginous, dehiscing at inner suture; seeds oblong-ovoid, light brown, dull-shiny, with dorsal rimmed furrow for nearly their entire length. Fl. April, Fr. June–August.

Dry sunny, pebbly and stony slopes of the lower mountain belt, escaped locally. — European part: Crim. (southern, mountainous). Gen. distr.: Med., Bal.-As. Min. Described from Europe. Type in London.

Economic importance. Ornamental shrubs. See also characteristics of the genus.

Section 2. *EURHAMNUS* Boiss. Fl. or. II (1872) 19. — Flowers in axillary fascicles, plants monoecious or dioecious, rarely flowers bisexual, 4-merous, with more or less developed petals; style 3-partite; ovary 3-locular; fruit succulent, globose or broadly obovoid, with 3 "stones"; seeds oblong-ovate, orbicular-trihedral, with deep rimmed dorsal furrow, smooth, shiny, pale yellow, coat (endocarp) thick, cartilaginous, broadly opening after ripening and falling of fruit. Unarmed shrubs; leaves alternate, deciduous, pinnately parallel-veined.

Series 1. *Grandifoliae* Grub. — Leaves large, chartaceous, thin, dark green, with numerous straight lateral nerves. Mesophyllous forest shrubs (including *R. fallax* Boiss. in addition to the species described here).

2. *R. imeretina* Booth in Kirchn. Arb. Muscav. (1864) 344; C.K. Schn. Laubholz. II, 275, f. 191, f–g; Koehne, Dendr. (1893) 393; Lipskii, Fl. Kavk. 270; Grossg., Fl. Kavk. III, 53. — *Rh. libanoticus* in Curtis Bot. Mag. (1883) 6721 et auct. al. non Boiss. — *Rh. grandifolia*

folia β . *brachypus* Boiss. Fl. or. II (1872) 22.— *Rh. alpina* var. *colchica* Kusn. in Bull. Ac. Sc. St.-Petersb. XXXIV (1892) 417, tab. 1.— *Rh. alpina* var. *grandifolia* Dipp. Laubh. (1898) 524, f. 252.— *Rh. colchica* Somm. et Lev. in Tr. B. S. XVI (1900) 107; Medv., Der. i kust. Kavk. (1919) 64.—? *Rh. alpina* Pall. Fl. Ross. II (1784) 23.— Ic.: Bot. Mag. 6721; Kusn. l. c.; Dipp. l. c.; Radde, Mus. Cauc. Bd. II, tab. 16.

Diffuse shrubs or trees 1.5–3(4) m high, with erect branches and green hairy shoots; buds large, up to 13 mm, ovoid-lanceolate, acute; leaves thin, dark green, dull above, glabrous or sparingly-hairy, pale beneath, yellowish-green, gray- or bronze-velutinous, usually elliptic but also oval to broadly lanceolate, (5)15(25) cm long, (3)7(12) cm wide, short-acuminate or attenuate into mucro at apex, rounded, truncate or faintly cordate at base, finely crenate-serrate at margin, with 15–25 pairs of slightly curved nerves, densely gray-velutinous beneath; petioles thick, 1.5–2.5 cm long, hairy. Flowers campanulate, 4–5 mm long, glabrous, with triangular-ovate, recurved lobes, 3–7 in axils, on 6–10 mm long pedicels; fruit globose, black, 6–7 mm in diameter; seeds lemon-yellow, ca. 4 mm long. Fl. end of May–June, Fr. July–September. (Plate XXXV, Figure 3.)

Edges and underwood of broadleaved and conifer mountain forests, open sunny slopes, among subalpine shrubs at forest edges, up to 2,000 m.—Caucasus: W. Transc., E. Transc. (Liyakhva basin), S. Transc. (Borzhomi, Bakuriani, Akhaltsikhe Kvirila River basin). Gen. distr.: As.-Min. (Lazistan). Description based on a garden specimen grown from seeds from Georgia.

Economic importance. A very showy, ornamental shrub.

Note. The description of "*R. alpina*" Pallas (Fl. Ross. II, 23) fully corresponds to the given species, yet its discovery at the upper reaches of the Uruk River on the northern slope of the Greater Caucasus, as reported by Pallas, is highly unlikely. The local name for the plant, "karama," refers to another species — *R. pallasii* F. et M.

Series 2. Microcarpae Grub.—Fruit very small; leaves small, coriaceous, grayish, shiny, few-nerved. Small rocky shrubs of the subalpine and alpine mountain belts.

3. *R. microcarpa* Boiss. Fl. or. II (1872) 20; Medv., Der. i kust. Kavk. (1919) 66; Grossg., Fl. Kavk. III, 52.—*R. h. rupestris* C.A.M. Ind. cauc. 133 non Scop.; Ldb. Fl. Ross. I, 503.—*Rh. cordata* Medw. in Vestn. Tifl. Bot. Sada, XXV (1912) 1; Der. i kust. Kavk. (1919) 65; Grossg., Fl. Kavk. III, 52.— Ic.: C.K. Schn. Laubholzk. II, 273, f. 191 h.

Prostrate shrubs up to 0.3 m high, strongly branching, with robust, gray or dark brown branches and glabrous or puberulent juvenile shoots; buds ovoid or ovate-lanceolate, 3–8 mm long, reddish- or violet-brown, with ciliate scales; leaves crowded on reduced shoots, rigid, thick-chartaceous, dull, green or grayish-green above, with compressed nerves, yellow beneath, dull or glaucescent or gold, glabrous or (var. *cordata* (Medw.) Grub. comb. nova) shortly spreading-hairy along nerves above and especially beneath, broadly oval or ovate, suborbicular or oblong-oval, (2.5)4.5(7) cm

long, (2)3(5) cm wide, obtuse or hardly acuminate or with short obtuse beak at apex, rounded or faintly cordate at base, irregularly and finely crenate-serrate at margin, with 7–10 pairs of strong nerves sharply protruding beneath; petioles strong, short-hairy only along groove or on the entire surface, 0.6–2 cm long. Flowers broadly campanulate, ca. 2.5 mm long, with broadly triangular calyx lobes, generally bisexual, (1)3–5 in axil, on thin glabrous or short-hairy pedicels up to 7 mm long; fruit obovoid, dryish, the ripe dark brown, ca. 4 mm long; seeds pale yellow, shiny, ca. 3 mm long. Fl. end of May–June, Fr. end of July–September. (Plate XXXV, Figure 1.)

Dry southern and southeastern limestone, rocky slopes, ravine walls, rock crevices, from 1,000 to 2,300 m. — Caucasus: Cisc. (Main Range east of the upper reaches of Terek River), W. Transc., S. Transc. (Borzhoi, Bakuriani). **Gen. distr.:** As. Min. (Lazistan, Turkish Armenia). Described from Lazistan. Type in Geneva.

Note. Medvedev described an independent species differing from the type by the sparsely pubescent leaves (beneath) and pedicels, and the densely pubescent petioles; this form is not deserving of a specific status since it is not distinguished from the type either geographically or ecologically and the character of pubescence features all transitional stages to type (i. e., in agreement with V. L. Komarov, it does not occupy a discrete place in nature).

4. *R. depressa* Grub. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, XII (1949). — *Rh. microcarpa* var. *microphylla* Trautv. in Tr. B. S. IV (1876) 123. — *Rh. microcarpa* var. *acutifolia* Medw. in Vestn. Tifl. Bot. Sada, XXV (1912) 3; Medved., Der. i kust. Kavk. (1919) 66; Grossg., Fl. Kavk. III, 53. — Exs.: Herb. Fl. Cauc. No. 134 (sub *Rh. microcarpa* var. *acutifolia* Medw.).

656 Prostrate shrubs up to 15 cm high, with dark brown or gray bark and short nodose branches; shoots violet or red-brown, puberulent; buds small, ovoid, up to 2 mm long; leaves crowded on reduced branches, with long persistent subulate stipules, rigid, coriaceous, glabrous, dull dark green or grayish above, dull or golden yellow beneath, broadly elliptic or oval, (6)15(20) mm long, (5)10(13) mm wide, rounded at apex and usually with short prickles or mucro (var. *acutifolia* (Medw.) Grub.), rounded or broadly cuneate at base, finely crenate-serrate at margin with 5–7 pairs of distinct nerves sharply protruding below; petioles short, 2–5 mm long, puberulent. Flowers narrowly campanulate, ca. 3 mm long, with lanceolate lobes, 2–3 in axil, on 3–5 mm long pedicels; fruit ca. 3.5 mm long, the ripe dark brown, 1–3 in axil; seeds ca. 2 mm long, pale yellow. Fl. May–June, Fr. July–August. (Plate XXXV, Figure 2.)

Rock crevices on dry, southern and southeastern mountain slopes, from 2,000 to 3,000 m. — Caucasus: Cisc. (eastern part), W. Transc. and S. Transc. (also Artvin and the former Kars Region), Dag. Endemic. Described from Akhaltsikhe. Type in Leningrad.

Section 3. CERVISPINA DC. Prodr. II (1825) 24. — Flowers in fascicles unisexual in dioecious plants, 4-merous, with very small, often obsolete (especially in pistillate flowers) petals; ovary 2–3- and 4-locular, with



PLATE XXXVI. 1 - *Rhamnus parvifolia* Bge., part of branch with fruits; 1a - endocarp, 1b - seed; 2 - *Rh. ussuriensis* J. Vass., branch with fruits; 3 - *Rh. erythroxylon* Pall., branch with fruits, 3a - seed; 4 - *Rh. dahurica* Pall., branch with fruits, 4a - flower, 4b - seed; 5 - *Rh. diamantiaca* Nakai, branch with fruits.

2-3- and 4-partite style; fruit with 2-3 and 4 "stones;" seeds with dorsal or lateral furrow. Mostly shrubs, rarely small trees, with spinose branches; leaves deciduous, pinnately nerved with curved veins.

Subsection 1. PRINCIPALES Grub. — Seeds with undeveloped testa and simple closed lateral furrow, in thin indehiscent and hardly separable endocarp. Large-leaved trees and large shrubs of the moderate forest zone (mainly E. Asia).

Series 1. *Utilis* Grub. — Fruit with "2 stones;" seeds plano-convex, without developed testa, dull; leaves with 4-6 pairs of lateral nerves. Forest zone of NE Asia. Additional to the 2 Russian species are *R. utilis* Decne, *R. hypochrysa* Schneid., and *R. nipponica* (Makino) Grub.

5. *R. dahurica* Pall. Reise III, Anh. (1776) 721; Ej. Fl. Ross. I, 24; Willd. Sp. pl. I, 2, 1097; DC. Prodr. II, 25; Ldb. Fl. Ross. I, 502; Turcz. Fl. baic.-dah. I, 270; Maxim. Prim. Fl. Amur. 76, p. p.; Rgl. Tent. Fl. uss. 43; p. p.; Kom., Fl. Man'chzh. III, 9, p. p.; C.K. Schn. Laubholz. II, 287 et in Pl. Wils. II, 4, 251, p. p.; Kom. and Al., Opr. 659 II, 793; Kitag. Lin. Fl. Mansh. 312, p. p. — *Rh. cathartica* var. β . *intermedia* et γ . *dahurica* Maxim. Rhamn. or.-as. (1866) 8-9, p. p. — Ic.: Pall. Fl. Ross. II, tab. 61; C.K. Schn. l. c. f. 192, m. p.; Yak. Vas. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, VIII, 115, f. I, a-c. — Exs.: G. R. F. No. 964.

Small trees up to 10 m tall, with black-brown splitting bark; branches opposite, light brown or gray; shoots usually hairy, gray-green, commonly terminated by large (up to 12 mm long), ovoid-lanceolate acute dark brown buds but sometimes with short prickles; leaves opposite on shoots and fascicled on reduced branches, coarsely chartaceous, dark green, dull above, gray-green beneath, glabrous or short-hairy, especially along nerves, usually oblong-oval or oval, 5-12 cm long, 3-7 cm wide, rounded or broadly cuneate, rarely slightly cordate at base, sharply tapering to short curved mucro, regularly crenate-dentate, with 4(5) pairs of strong, obliquely curved, whitish nerves; petioles thick, long (1.5-3 cm). Flowers narrowly infundibular-campanulate, 4-6 mm long, glabrous, with lanceolate acute erect lobes, on pedicels ca. 1 cm long, in axillary fascicles of 2-5, 10-20 crowded together on reduced branches; fruit globose, with 2 "stones," 5-7 mm in diameter, black-blue, often with sky blue bloom; seeds large, obliquely oval, much compressed, with straight closed lateral slit for the entire length, coat thin, hard, nearly indehiscent. Fl. end of May-June, Fr. September. (Plate XXXVI, Figure 4.)

Forest edges, banks of rivers and streams, under canopy of broadleaved and mixed forests, sometimes in burned and felled areas. — E. Siberia: Dau. (not beyond the Yablonovy Range); Far East: Ze.-Bu. (S.), Uda (along the Amur up to Mariinsk); Uss. Gen. distr.: Mong. (NE), Jap.-Ch. (Manchuria, N. Korea). Described from Dauria. Type in London.

Economic importance. See characteristics of the genus.

Note. The plants in Dauria grow as shrubs with slightly smaller leaves, flowers and fruits, probably because of the harsh climate. This species apparently hybridizes here with *R. parvifolia* Bge. because there are forms (in the herbarium of the Botanical Institute, from Nerchinsk district and Onon) featuring basic characters (shape and venation of leaves, texture of the seeds, shape of the buds, character of branching) intermediate between these two species. The presence of these hybrid forms is probably the cause of the dual character in Turchaninov's diagnosis of *R. polymorpha* and also of Ya. Yasil'ev's error in assuming them to be *R. dimantiaca* Nakai, which extends in the west only up to (approximately) the meridian of Blagoveshchensk.

6. ***R. ussuriensis*** J. Vass. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, VIII (1940) 115. — *Rh. cathartica* β . *intermedia* et γ . *dahurica* Maxim. Rhamn. or.-as. (1866) 9, p. p. — *Rh. dahurica* Rgl. Tent. Fl. uss. (1885) 43, p. p. non Pall.; Kom., Fl. Man'chzh. III, 9, p. p.; Nakai, Fl. kor. I, 125; II, 460; Ej. Fl. Sylv. Koreana, IX, 30, p. p.; Kom. and Alis., Opr. II, 793, p. p.; Kitag. Lin. Fl. Manch. 312, p. p. — *Rh. dahurica* var. *nipponica* Nakai, Fl. Sylv. Koreana, (1920), IX, tab. 12–13.

Shrubs, up to 5 m high, with opposite, virgate, olive-gray or light brown, smooth branches terminated by a spine; buds lanceolate, acute, brown, up to 7 mm long; leaves thick-chartaceous, coarse, dark green above, glossy (dried ones dull) and glabrous, pale beneath, grayish (dried often yellowish), glabrous, or shortly white (often yellowish) — hairy only along midrib, regularly serrulate at margin, with glandular teeth, with 5–6 pairs of yellowish or violet-red strong nerves, leaves on shoots opposite, oblong-elliptic to lanceolate, 5–9 cm long, 1.8–3.5 cm wide, gradually attenuate to long mucro, cuneate at base, nerves strongly protruding beneath, sharply diverging from midrib, leaves on leaf-bearing reduced branches usually obovate or oval, always smaller, 2–5 cm long, 1.2–4 cm wide, obtuse or sharply tapering to short, more or less curved tip, cuneate at base, nerves frequently protruding beneath; petioles thick, 1.5–3 cm long. Flowers narrowly infundibular-campanulate, 3–4 mm long, on pedicels ca. 1 cm long, 2–5(8) in each axil; calyx glabrous, with ovate-lanceolate erect lobes; fruit globose, ca. 6 mm in diameter, black, shiny, with 2 "stones," 10–20 crowded together; seeds as in preceding species, ca. 4.5 mm long, with wider slit. Fl. end of May–June, Fr. end of August–September. (Plate XXXVI, Figure 2.)

Flooded river valleys among shrubby formations, sandy ridges and thicket on sandbanks, riparian rocks. — Far East: Ze.-Bu. (east up to the longitude of Blagoveshchensk), Uss. (north up to Khabarovsk). **Gen. distr.:** Jap.-Ch. (from E. Mongolia to N. Korea). Described from the southern Maritime Territory. Type in Leningrad.

Economic importance. See characteristics of the genus.

Note. Closely related to *R. utilis* Dcne. At the southern border of its distribution area (Peiping) it touches on the northern border of *R. utilis* Dcne. from which it is difficult to distinguish.

Series 2. *Catharticae* Grub. — Fruit with 3–4 "stones"; seeds ovoid, orbicular, with faint ventral plane and acute often cartilaginous beak, smooth, dull; leaves with 3 pairs of lateral nerves. Forest and forest-steppe zone of Europe and W. Siberia. Besides *R. cathartica*, *R. persicifolia* Moris. endemic for Sardinia is included in this series.

7. *R. cathartica* L. Sp. pl. (1753) 193; DC. Prodr. II, 24; Ldb. Fl. Ross. I, 501; Ej. Fl. alt. I, 252; Shmal'g., Fl. I, 204; Kryl., Fl. Zap. 661 Sib. VIII, 1889; B. Fedch., Rast. Turk. 566; Grossg., Fl. Kavk. III, 51; Hegi, Ill. Fl. V, 1, 332. — *R. spinosa* Gilib. Fl. lithuan. V (1785) 132. — Ic.: Hegi, l. c. tab. 180, f. 4, a–e; Schlechtend. Fl. Deutschl. tab. 2183. — Exs.: G. R. F. No. 1014.

Strongly branching diffuse shrubs or small trees up to 8 m tall, with scabrous splitting and peeling nearly black bark; branches spinose, opposite, with red-brown shiny bark, as in *Prunus*; buds oblong-ovoid, 3–7 mm long, violet-brown or brown; leaves opposite on juvenile shoots and fascicled on fertile branches, more or less chartaceous, bright green or grayish, dull or slightly glossy above, paler beneath, glabrous or sparingly pubescent at both faces, but more so beneath (f. *pubescens* Lge.), highly variable in shape, elliptic to orbicular but commonly oval, (2)3–5(6) cm long, (1.2)1.5–3(4) cm wide, short-acuminate, obtuse or mucronulate, broadly cuneate or rounded, rarely broadly cordate at base, generally crenate-serrate, with strong petioles with 3 pairs of nerves much protruding beneath, arcuately converging at apex; petioles 1–2 cm long (2.5–3 cm long — f. *longipetiolata* Grub.), strong. Flowers narrowly campanulate, 10–15 in fascicle, 4–5 mm long, on pedicels 5–8 mm long; calyx with triangular-lanceolate, acute, usually recurved lobes; fruit globulose, 6–8 mm in diameter, the ripe black, shiny, 3–10 together; seeds ovoid, 5 mm long, with narrow lateral slit, dorsally inflated, weakly planed at ventral side, coat thin, hard, indehiscent. Fl. May–June. Fr. August–September. (Plate XXXVII, Figure 3.)

Open, usually dry places, shrubby formations, steppe-forest outliers, hilly slopes, dry broadleaved open stand forests, steep riverbanks, riparian meadows, gravels, pebbly and stony mountain slopes, sometimes thickets, up to 1,700 m. In the north the species is distributed: up to 61°40' in Scandinavia (Norrländ); up to 59°30' in the European part of the USSR (Pavlovsk) and up to 56°40' in W. Siberia (north of Shadrinsk); in the south to 36° (Algiers, and Cilicia in Asia Minor); in the east it reaches the Ob River (Barnaul) and W. Altai (Naryn Range). — European part: Balt., Lad.-Ilm., U. V., V.-Kama, U. Dnp., M. Dnp., V.-Don, Transv., U. Dns., Bes., Bl., Crim., L. Don, L. V.; Caucasus: all regions except W. Transc.; W. Siberia: U. Tob., Irt. (up to Ob), Alt. (Irtysk area); Centr. Asia: Ar.-Casp. (northern part — Mugodzhary, Turgai, Ulu-Tau), Balkh. (N. and E.), Dzu.-Tarb., Syr D. (SE), Pam.-Al. (eastern part — Karategin, Gulcha), T. Sh. Gen. distr.: Scand., Centr. Eur., Atl. Eur. (excluding Portugal), W. Med., Bal.-As. Min., excluding the Aegean Islands, Arm.-Kurd. (N.).

- Economic importance. A medicinal plant. The ripe fruits (*Fructus rhamni cathartici* or *Baccae spinæ cervinae*) in syrup form (*Sirupus* 662 *rhamni cathartici*) are known for their emetic and purgative properties and in former times were in wide use. In jelly form they are of medical value in W. Europe in the treatment of dropsy, gout, and chronic skin diseases (Hegi). The bark (*Cortex rhamni cathartici*), like that of

Frangula alnus Mill., is a powerful emetic and purgative. The handsome timber, hard with reddish veins or marble-like grain, is used in woodwork and carpentry. An ornamental plant, sturdy and unpretentious, cultivated in the North. Also planted as hedges. A secondary host of *Puccinia coronifera* Kleb. See also characteristics of the genus.

Note. There are more xeromorphic and usually pubescent populations in the southern part of its distribution area, alongside the type. These might give rise to numerous forms, varieties and even species. Thus, in the Caucasus there is the more commonly pubescent form, described as var. *caucasica* by N. I. Kuznetsov, which yields all transitional stages to the typical glabrous form; in Central Asia the more coarse-leaved and long-petiolate form (f. *longipetiolata* Grub.) is quite common.

This species hybridizes with related ones (see note to *R. spathulifolia*). Judging by the description and drawing **R. sukatschewii* E. Wolf (in "Ocherki po fitosots. i fitogeogr." (1929) 383) is an accidental, monstrous form that probably originated through the hybridization of *R. cathartica* L. with one of the related species in cultivation.

Subsection 2. VIRGATIFORMES Grub. — Fruits usually with 2 "stones"; seeds with lateral furrow open only at lower end, smooth, coat hard, splitting after ripening and falling of fruits; styles in pistillate flowers usually 2, rarely 3. Mountain forest shrubs of E. Asia.

Series 3. Japonicae Grub. — Seeds smooth, shiny, dark brown or black, furrow lateral, simple, closed, coat dehiscing by narrow bright-cartilaginous-rimmed slit, at the lower end (up to $\frac{1}{3}$); leaves with 3–5 pairs of nerves. Armed shrubs, with smooth silvery or golden (as in *Prunus*) branches, distributed in the moderate forest zone of E. Manchuria, southern part of the Amur area, Korea, and N. Japan (also included here are *R. japonica* Maxim., *R. schneideri* Lev., and *R. koraiensis* C. K. Schn.).

8. *R. diamantiaca* Nakai in Tokyo Bot. Mag. XXXI (1917) 98; Ej. Fl. Sylv. Koreana, IX, 27; Yak. Vas. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, VIII (1940) 115. — *Rh. virgata* var. *sylvestris* Maxim. Rhamn. or.-as. (1866) 13, f. 30–32. — *Rh. globosa* Kom., Fl. Man'chzh. III (1907) 11, p. p. non Bge.; Kom. and Alis., Opred. II, 733. — *Rh. parvifolia* Nakai, Fl. Sylv. Koreana, IX (1921) 28, tab. II, non Bge. — *Rh. parviflora* Kitag. Lin. Fl. Mansh. (1933) 312, p. p. — Ic.: Nakai, l. c. tab. 10 et 11.

Diffuse shrubs, with smooth shiny dark or red-brown spreading opposite spinose branches; buds small, obtuse; leaves thick-chartaceous, dark green, glaucescent or grayish, dull above, glabrous or sparsely hairy, light green and glabrous beneath, broadly oval, oval-rhombic or, rarely, obovate, 2.5–6(7) cm long, 1.5–4 cm wide, sharply tapering above to obtuse tip, cuneate or subrounded at base, finely crenate-dentate, with 4 pairs of arcuate nerves; petioles up to 2 cm long. Flowers infundibular-campanulate, 2.5–3.5 mm long, glabrous, 2–3 in axil, on ca. 8 mm long pedicels, 5–15 crowded on shoot; fruit globose or broadly obovoid, black; seeds ovoid,

slightly compressed, cinnamon or dark brown, with short (up to $\frac{1}{3}$ of length), oval, yellow-cartilaginous-rimmed slit at lower end. Fl. end of May–June; Fr. September. (Table XXXVI, Figure 5.)

Edges and clearings in broadleaved and mixed forests, steep riverbanks and riparian cliffs. — Far East: Ze.-Bu. (up to Selemdzha in the west), Uss. **Gen. distr.:** Jap.-Ch. (E. Manchuria, N. Korea, Liaotung). Described from Korea. Type in Tokyo.

Economic importance. See characteristics of the genus.

Note. See *R. dahurica*.

Series 4. *Parvifoliae* Grub. — Seeds brown, dull-glossy, coat broadly dehiscent, furrow deep, open, with cartilaginous rim; leaves coarse-chartaceous, dark green and dull above, pale beneath, with 2–4 pairs of lateral nerves. Small, spinose, xerophyllous, crooked shrubs of foothills and the lower mountain belt of Mongolia, N. Manchuria and NW China (*R. tangutica* J. Vass., *R. potanini* J. Vass. and others).

9. *R. parvifolia* Bge. Enum. Pl. Chin. bor. (1831) 14; Maxim. Rhamn or.-as. 16, p. p.; Kom., Fl. Man'chzh. III, 12; C.K. Schn. Laubholz. II, 285 et in Pl. Wils. II, 4, 250, p. p.; Kom. and Alis., Opr. II, 733; Yak. Vas. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, VIII (1940) 113. — *Rh. polymorphus* Turcz. in Bull. Soc. Nat. Mosc. XV (1842) 713; Ej. Fl. baic.-dah. I, 269, p. p. — *Rh. virgata* β . *aprica* Maxim. Rhamn. or.-as. (1866) 14. — *Rh. parviflora* Kitag. Lin. Fl. Mansh. (1933) 312, p. p. — Ic.: Yak. Vas. l. c. 125, f. 2; C.K. Schn. Laubholz. II, p. p. 192, i, 1 et 196, x, y.

664 Rigid, spreading-branching shrubs, with silvery-gray bark and opposite spinose usually red-brown branches; leaves fascicled on reduced branches and opposite on shoots, thick, glabrous, dark green and dull above, pale beneath, rhombic-oval or obovate, (1)1.5–2.5(3) cm long, (0.5)0.8–1.5 cm wide, sharply tapering to obtuse tip or rounded, cuneate at base, finely crenate-dentate, with 3 pairs of arcuate nerves; petioles strong, 0.4–1 cm long. Flowers campanulate, with erect lobes, 2.3 mm long, glabrous or sparingly short-hairy, on thin pedicels up to 6 mm long, 1–3 in axil; ripe fruit slightly fleshy, black, and globose or dry, obovoid and greenish, 3–4 mm long; seeds ovoid, compressed, 2.5–3 mm long, dark or olive-brown, with yellow rimmed lateral slit, reaching $\frac{3}{4}$ of way up seed. Fl. end of May – beginning of June; Fr. July–September. (Plate XXXVI, Figure 1.)

Open, dry and sunny, rocky or stony slopes of hills and mountains. — E. Siberia: Dau. (up to Yablonovy Range in the east), Lena-Kol. (along the Vitim River in the north up to Oron Lake). **Gen. distr.:** Mong. (Jehol and Chakhar), Jap.-Ch. (N. China). Described from Peking district. Type in Paris?

Subsection 3. *CATHARTICIFORMES* Grub. — Fruit with 3–4 "stones"; seeds with dorsal rimmed and open furrow, coat hard, cartilaginous, dehiscent. Shrubs, with opposite leaves and spinose branches.

Series 5. *Petiolares* Grub.—Fruit usually globose, succulent; seed testa dehiscing by narrow slit. Leaves long-petioled. Small trees and shrubs of moderate forests in the mountain zones of Central Asia and Asia Minor (*R. petiolaris* Boiss., *R. orbiculata* Bornm.).

10. *R. dolichophylla* N. Gontsch. in Tr. S.A.G.U., ser. VIII b, 17 (1934) 93.—Exs.: Herb. Fl. As. Med. No. 575.

Small trees, 3.5–6.5 m tall, with dark brown or gray-brown thin bark (typical of *Prunus*); branches dark gray or nearly black, usually opposite, usually terminated by short spine, juvenile branches reddish-brown, finely pubescent; buds up to 3 mm long, inconspicuous; leaves fascicled on reduced branches and diagonally opposite on juvenile shoots, thick-chartaceous to thin-coriaceous then very thin, minutely pubescent especially along nerves, dull, gray- or yellowish-green above, paler, grayish-green beneath, oblong-elliptic or oval, lanceolate-elliptic or oblong-obovate, (2.5)4–7(8) cm long, (0.7)1.5–3(4) cm wide, cuneate to rounded at base, usually short-acuminate but sometimes subrounded or attenuate-mucronate at apex, hardly crenate-serrate at margin, with 4–6 pairs of arcuate lateral nerves and strong midrib; petioles much developed, long (1.5–3 cm). Flowers infundibular-campanulate, with ovate-lanceolate obtuse lobes, ca. 4 mm long, finely pubescent, on strong pedicels ca. 8 mm long, usually bisexual, 10–30 in fascicle; fruit globose, succulent, black or brown, ca. 7 mm in diameter, with 2–4 "stones"; seeds oblong-ovoid, obtusely trihedral, 4–5.5 mm long, shiny, light brown, furrow dorsal, deep, with white-cartilaginous rim along entire length, coat (endocarp) hard, cartilaginous, pale yellow, broadly dehiscing. Fl. May–June, Fr. August–September. (Plate XXXVII, Figure 4.)

Stony, pebbly, pebbly-clayey slopes, gravelly sandbanks of rivers, ravines, shrubby formations in the woody-shrubby mountain belt, 1,200 to 2,500 m.—Centr. Asia: Pam.-Al. (C.). Endemic. Described from Tadzhikistan. Type in Tashkent.

Economic importance. See characteristics of the genus. A copious fruit-bearing plant.

Series 6. *Infectoriae* Grub.—Fruit usually dry, divided, seed coat dehiscing by broad slit; leaves with few arcuate nerves converging towards apex, short-petiolate; stipules long persistent and nearly as long as leaves. Mountain shrubs of Europe (*R. saxatilis* L., *R. infectoria* L. and the Russian species *R. tinctoria* W. et K.).

11. *R. tinctoria* Waldst. et Kit. Pl. rar. Hung. III (1812) 283; DC. Prodr. II, 24; Boiss. Fl. or. II, 18; Jávorka, Fl. Hungar. 699.—*Rh. saxatilis* Fedch. and Fler., Fl. Evrop. Ross. (1910) 625, non Jacq.—*Rh. saxatilis* var. *tinctoria* (W. et K.) Hegi, Ill. Fl. V, 1 (1925) 336.—Ic.: Waldst. et Kit. l. c. tab. 225; Jávorka, Ic. Fl. Jungar, 328, f. 2324; Schlecht. Fl. v. Deutschl.—XXI, tab. 2184.—Exs.: Fl. exs. austro-hung. No. 2035.

Erect, 1–1.5 m high, loose shrubs, furcately branching with spine between divergent branches, branches thin, drooping, silvery-gray or light brown ("cherrylike"), juvenile branches brown, finely pubescent; leaves

thick-chartaceous, dark green and dull above, pale green beneath, finely pubescent at both faces and along petioles, with subulate long persistent stipules, on reduced fertile branches tufted, oblong-obovate and cuneate at base, or elliptic, 1.5–3.5 cm long, 1.8 cm wide, obtuse or short-acuminate at apex; on sterile and shady shoots opposite, oval, with short obtuse mucro, or just rounded, 3–5 cm long, 2–3 cm wide, all crenate-dentate or serrate, with 2–3 pairs of lateral nerves converging at apex; petioles 5–8 mm long; flowers narrowly campanulate, 4–5 mm long, short-pedicel, in fascicles of 5–10; calyx with triangular-lanceolate lobes; ripe fruit black or yellow, with 2–3(4) inflated segments, 5–7 mm long, 2–5 on shoot; seeds ovoid, 4–5 mm long, with open, pale rimmed dorsal furrow and pale ventral plane, faintly crested at apex, brown, dull-shiny, coat thin-cartilaginous, broadly dehiscing. Fl. May–June, Fr. September–October.

366 Shady, pebbly and stony slopes of hills and mountains, shrubby formations, light dry groves. Reported from Bes. Possible in U.Dns. Gen. distr.: Centr. Eur. (SE), Bal. Described from S. Hungary. Type in Vienna.

Economic importance. Ornamental shrub. See characteristics of the genus. Bukovina should apparently be referred to *R. tinctoria* W. et K.

Subsection 4. *PETROPHILAE* Grub. — Fruit usually with 2–3, rarely 4 "stones," slightly succulent; seeds with open and rimmed dorsal furrow sometimes parted at upper end by small appendage — protuberance of the external coats of seed, coat (endocarp) hard, cartilaginous, broadly opening. Spiny xerophyllous shrubs with alternate branches; leaves small [?] with 4 pairs of lateral nerves.

Series 7. *Erythroxydon* Grub. — Leaves linear-lanceolate, large, up to 10 cm long; fruit succulent, with 3–4 "stones"; seeds asymmetrical, dull, with deep, hardly rimmed dorsal furrow, without appendage at upper end, often divided inside by longitudinal septum. One species only.

12. *R. erythroxydon* Pall. Reise, III, Anh. (1776) 722, tab. I, f. 1; Ej. Fl. Ross. II, 26; DC. Prodr. II, 25, excl. var. β . *angustifolius*; Ldb. Fl. Ross. 503; Turcz. Fl. baic.-dah. I, 268; Maxim. Rhamn. or.-as. 7; Ej. Enum. pl. Mong. I, 137. — Ic.: Pall. Fl. Ross. II, tab. 42; C. K. Schn. Laubholz. II, f. f. 193b et 194f.

669 Strongly branching spinose shrubs, up to 2 m high, with stem up to 3 cm in diameter; branches rigid, dark gray or nearly black, the young dark cherry-red, shiny, prickly branches; leaves fascicled on reduced fertile branches, thick-chartaceous, short, hardly pubescent or subglabrous, dark green above, grayish beneath, often yellowing when dry, linear to oblong-linear, 3–10 cm long, 2–10 mm wide, regularly acuminate and tapering to 0.5–1.5 cm long petioles, with small acute teeth at slightly rolled margin, midrib strongly protruding beneath, with 4 pairs of inconspicuous oblique lateral nerves. Flowers broadly campanulate, ca. 2 mm long, with triangular-lanceolate acute calyx lobes, yellow, on short pedicels, 10–20 in fascicle; ripe fruit globose, 5–6 mm in diameter, black, shiny, usually with 3 "stones," 5–10 on branch; seeds 3–4 mm long, obliquely ovoid,



PLATE XXXVII. 1 — *Rhamnus baldschuanica* Grub., branch with fruits; 1a — testa (endocarp), 1b — seeds from dorsal side; 2 — *Rh. pallasii* F. et M., branch with fruits; 2a — testa, 2b — seed from dorsal side; 3 — *Rh. cathartica* f. *longipetiolata* Grub., branch with fruits; 3a — "stone" (seed in testa), 3b — seed from dorsal side; 4 — *Rh. dolichophylla* Gontsch., fruit-bearing branch, 4a — testa, 4b — seed from dorsal side; 5 — *Rh. sintenisii* Rech. f., fruit-bearing branch; 5a — testa, 5b — seed from dorsal side.

obtusely faceted, brown, dull, with broad hollow furrow, sometimes parted inside by longitudinal septum; coat thin-cartilaginous, whitish, partly dehiscing. Fl. May, Fr. August–September. (Plate XXXVI, Figure 3.)

Dry rocky and stony slopes of hills and low mountains. — E. Siberia: Ang.-Say., Dau. (southern Transbaikalia and Selenga Dauria). **Gen. distr.:** Mong. Described from Dauria. Type in London.

Economic importance. The timber is beautiful and very durable. It is called "red tree" by the local population and is used for making small objects.

Series 8. **Pallasianae** Grub. — Leaves variable in shape, small; fruit somewhat succulent, with 2–3–4 "stones"; seeds smooth, shiny, with forked dorsal furrow at upper end. From the Himalayas to the Caucasus.

13. *R. pallasii* Fisch. et Mey. in Ind. sem. h. Petropol. IV (1837) 46 et in Hohenack. Enum. pl. Talysch. (1837) 100; Ldb. Fl. Ross. I, 503; Boiss. Fl. or. II, 17; Shmal'g., Fl. I, 204, excl. subsp. β . *spathulifolia*; Medved., Der. i kust. Kavk. (1919) 63; Grossg., Fl. Kavk. III, 52; C.K. Schn. Laubholzk. II, 277. — *Rh. lycioides* Pall. Reise, III (1774) 591, non L.; Ej. Fl. Ross. (1788) 11, 26, non L. — *Rh. erythroxy-lon* M.B. Fl. taur.-cauc. I (1805) 168, non Pall. — *Rh. erythroxylon* β . *angustifolius* DC. Prodr. II (1825) 25. — *Rh. tortuosa* Somm. et Lev. in Bull. Soc. Bot. Ital. (1893) 26 and in Tr. B. S. XVI (1900) 106. — Ic.: Pall. Fl. Ross. II, tab. 43; Tr. B. S. XVI, tabl. XIV; C.K. Schn. l. c. f. f. 193, c–c². — Exs.: Herb. Fl. Cauc. No. 431.

Small, spreading-branching, crooked or creeping shrubs, up to 2 m high, with firm spinose branches and usually red-brown virgate ("willow-like") shoots; buds inconspicuous; leaves fascicled on reduced leaf-bearing branches, coarsely chartaceous, finely hairy or subglabrous, dull green, grayish or yellowish-green above, usually yellow-green beneath, linear or linear-lanceolate to spatulate, always widest at upper end, 1.5–6 cm long, 1.5–6 mm wide, short-acuminate, obtuse or rounded at apex, gradually tapering to petiole, finely crenate-serrate (teeth usually with black gland at top) at the slightly rolled margin, with strong midrib protruding beneath and 4 pairs of oblique inconspicuous lateral nerves. Flowers broadly infundibular-campanulate, ca. 1.5 mm long, or hardly noticeably pubescent, 10–20 in fascicle, short-pedicled; sepals yellow, glabrous with recurved triangular acute lobes; fruit globose, succulent and black, or obovoid, dry and brown, ca. 4 mm long, with 2–3 "stones," 2–10 together; seeds oblong-ovoid, yellow to olive-brown, with narrow, rimmed furrow shortly-forked above, coat (endocarp) hard, cartilaginous, broadly dehiscing, yellow or orange. Fl. April–May, Fr. July–September. (Plate XXXII, Figure 2.)

Dry, sunny, pebbly, stony or rocky slopes of hills and foothills, rock crevices, cornices, ravine walls, up to 1,500 m, mainly on limestones. — Caucasus: all regions except W. Transc. **Gen. distr.:** As. Min., Arm.-Kurd. (N.), Iran. (Gilan). Described from Azerbaidzhan. Type in Leningrad.

14. *R. spathulifolia* Fisch. et Mey. in Ind. sem. h. Petropol. IV (1837) 46 et in Hohenack. Enum. pl. Talysch. (1837) 99; Ldb. Fl. Ross. I, 502; Boiss. Fl. or. II, 17; C.K. Schn. Laubholzk. II, 279; Medved., Der. i

kust. Kavk. (1919) 62; Grossg., Fl. Kavk. III, 52.— *Rh. pallassii* var. *spathulifolia* Schmalh., Fl. I (1895) 204; Maxim. Rhamn. or.-as. 8.— *Rh. cathartica* var. *spathulaefolia* Rgl. in Tr. B.S. IV, 2 (1876) 329.— Ic.: C.K. Schn. l. c. f. f. 193, a—a³ et 194g.

Spreading-branching shrubs, up to 2 m high, with virgate spinose branches; buds inconspicuous, the more developed ovoid, up to 2 mm long; leaves in bundles or alternate, lanceolate to elliptic, 2.5–7 cm long, 0.8–2 cm wide, acute or obtuse at apex, cuneate at base or gradually tapering to strong petiole up to 1.5 cm long, either finely crenate-dentate or irregularly denticulate at slightly rolled margin, with thick midrib and 4 pairs of strong lateral nerves protruding beneath, coarsely chartaceous, dull above, either conspicuously or inconspicuously puberulent. Flowers broadly infundibular-campanulate, ca. 2.5 mm long, 10–15 in fascicle; calyx with recurved triangular-lanceolate acute lobes; fruit globose, succulent and black or obovoid, often obliquely dryish and brown, with 2–4 "stones," 4–7 mm long; seeds in thin or thick cartilaginous testa, oblong-ovoid, 3–5 mm long, usually shiny, light yellow to dark brown, with dorsal or lateral furrow very inconsistent in shape — sometimes closed, unrimmed, as in *R. cathartica*, sometimes broadly rimmed and shortly forked above as in *R. pallasii*, and sometimes intermediate in form. Fl. April–June, Fr. June–September.

Dry steppe slopes, shrubby formations, in pebbly, stony or rocky places, forest edges, banks of rivers and streams, herbaceous slopes, in mountains up to 1,000 m. — Caucasus: all regions except W. Transc. Gen. distr.: Arm.-Kurd. (N.), Iran (Gilan). Described from Azerbaidzhan. Type in Leningrad.

Note. A "species" with extraordinarily inconsistent characters, undoubtedly representing a hybrid of *R. cathartica* L. and *R. pallasii* Fisch. et Mey. In shape and venation of the leaves, buds, fruit and structure of the seeds it is very close to the first; 60–70% of the pollen is sterile. Common mainly in dry areas (Dagestan, E. and S. Transc.) where both original species are almost undifferentiated ecologically.

15. *R. sintenisii* Rech. f. in Ann. Naturhist. Mus. Wien, LI (1941) 398.— *R. pallasii* B. Fedtsch., Rast. Turk. (1915) 566 et auct. al. non Fisch. et Mey.— *R. spathulifolia* B. Fedtsch. ibid. et auct. al. non Fisch. et Mey.— *R. transcaspica* Grub. in manuscr. (1945) et in herb.

Very polymorphic spinose shrubs, small, crooked, strongly branching, less than 0.5 m high or fruticose and up to 2.5 m high, with dark brown-gray or nearly black bark, with virgate branches (in shady and irrigated localities), juvenile branches shiny, red-brown; buds inconspicuous; leaves coarsely chartaceous, rarely subcoriaceous, subglabrous or puberulent especially at base and along petioles, commonly green or grayish-green, dull above, paler beneath, fascicled on reduced fertile branches and alternate on juvenile shoots, usually spatulate or lanceolate, 15–20 mm long, 4–5 mm wide, oblong-spatulate and broadly lanceolate or elliptic (on shady shoots up to 3.5 cm long, 1.3 cm wide), usually obtuse or rounded, rarely short-acuminate at apex, usually narrowly cuneate at base, finely glandular-serrate

or crenate at margin, with strong protruding midrib and 4 pairs of inconspicuous lateral nerves; petioles strong, 3–10 mm long. Flowers broadly campanulate, 10–20 in fascicle, short-pediceled; calyx lobes triangular-ovate, ca. 2 mm long, glabrous; fruit usually dryish, dark brown, divided, ca. 4 mm long, with 2–3 "stones," 2–5 together; seeds oblong-ovoid, orbicular-trihedral, ca. 3 mm long, usually pale yellow or pale brown, with broad rimmed furrow, $\frac{3}{4}$ as long as seed, parted above by long appendage often forked by itself. Fl. April–June, Fr. July–August. (Plate XXXVII, Figure 5.)

Dry clayey, pebbly or stony slopes of hills and mountains, along cliffs and ledges of ravines, rock crevices, mostly on chalks, up to 1,500 m. — Centr. Asia: Ar.-Casp. (Mangyshlak, Caspian coast up to Kara-Bogaz-Gol gulf), Mtn. Turkm. **Gen. distr.:** Iran (N. Iran west to Elburz). Described from Iran. Type in Vienna.

16. *R. coriacea* (Rgl.) Kom. in Tr. Peterb. Obshch. Est. XXVI (1896) 161; B. Fedch., Rast. Turk. 566; Fl. Zap. Tyan'-shanya, 279. — Rh. cathartica γ . *coriacea* Rgl. Tr. B. S. IV, 2 (1876) 322. — Rh. cathartica var. *seravschanica* Kom. l. c. 161.

Spinose, crooked-branching and generally prostrate shrubs, 0.4–1 m high, with light gray, gray-brown or nearly black scabrous bark; juvenile branches smooth, brown, often thornlike, seldom (shady) virgate; buds inconspicuous; leaves fascicled on reduced fertile branches, usually thick, coriaceous, glabrous or puberulent only at base and along petioles, gray-green, unicolored, dull, broadly spatulate to oval or orbicular, rarely broadly lanceolate (f. *lanceolata* Grub.), 1–1.5 cm long, 0.5–1 cm wide, up to 2.5 cm long, 1.1 cm wide (on shady shoots alternate, usually elliptic, 1.8–2.5 cm long, 1–1.3 cm wide), obtuse or rounded at apex, cuneate at base, subentire or usually with acute and recurved teeth at the sometimes weakly rolled margins, with strong midrib and usually distinctly protruding arcuate lateral nerves; petioles strong, 3–8 mm long. Flowers 2–2.5 mm long, broadly campanulate, finely hairy or subglabrous, short-pediceled, 3–10 in fascicle; fruit globose, succulent, black, 4–5 mm in diameter, with 3–4 "stones," 1–5 together; seeds oblong-ovoid, 3–4 mm long, pale yellow to brown, with narrow rimmed furrow parted above by short appendage, coat very hard, cartilaginous, broadly dehiscent when ripe. Fl. April–June, Fr. July–August.

Pebbly and stony mountain slopes, stony river terraces, taluses, rock crevices, cornices and cliffs, from 300 to 2,500 m. — Centr. Asia: Syr D., Pam.-Al. (basin of the Zeravshan), T. Sh. (NW — basin of the Syr Darya, Naryn). Endemic. Described from Zeravshan. Type in Leningrad.

Note. A very polymorphic species requiring further study, especially in nature. It is possible that the widespread f. *lanceolata* in Kirghizia deserves a specific status, but the lack of material at hand precludes such a change.

17. *R. baldschuanica* Grub. in Bot. Mat. Gerb. Bot. Inst. AN SSSR, XII (1949).

Shrubs, 0.5–1.5 m high, with erect often virgate spinose branches and grayish or dark brown to nearly black bark; leaves fascicled on reduced fertile branches, coarsely coriaceous, usually finely and densely pubescent,

rarely glabrous, dull, gray-green, unicolored, lanceolate or narrowly lanceolate, rarely spatulate-lanceolate, 1.5–2.5 cm long, 0.4–0.7 cm wide, acuminate or obtuse at apex, gradually tapering to petiole, finely glandular-serrate or subentire at margin (on shady shoots broadly lanceolate or elliptic, 2–2.5 cm long, 0.7–1.1 cm wide, acutely toothed), with strong midrib protruding beneath and inconspicuous lateral nerves; petioles strong, short. Flowers 1.5–2 mm long, broadly campanulate, 3–5 together, on pedicels 3–5 mm long; fruit globose and black, or divided and brown, ca. 5 mm in diameter, with 2–3 "stones," 1–3 together; seeds ovoid, plane-inflated, 3–4 mm long, pale yellow, with flat furrow along entire width of seed, shortly parted above by small appendage, coat hard, cartilaginous, broadly dehiscent when ripe. Fl. April–May, Fr. July–August. (Plate XXXVII, Figure 1.)

Limestone, stony slopes, rocks, outcrops, in the wood-shrubby vegetation belt, 600 to 1,800 m. – Centr. Asia: Pam.-Al. (SW). Endemic. Described from Baldzhuan. Type in Leningrad.

18. *R. minuta* Grub. in Bot. Mat. Gerb. Inst. AN SSSR, XII (1949), cum tab.

Profusely short-branching, creeping or pulvinate compact shrubs, 10–25 cm high, with dark gray or gray-brown bark and many acicular glabrous spines; leaves fascicled on reduced branches, very small, obovate or oval, 5–10 mm long, 2.5–6 mm wide, rounded or obtuse, rarely acuminate at apex, broadly cuneate at base, acutely denticulate at margin, thin-coriaceous, bright green, unicolored, sparingly puberulent, with developed midrib and 4 pairs of inconspicuous lateral nerves, short-petioled. Flowers broadly campanulate, ca. 1.5–2 mm long, glabrous, short-pedicelled, 2–5 together; fruit obovoid, divided, 3–4.5 mm in diameter, dryish, dark brown, with 2–3 "stones"; seeds oblong-ovoid, oblique, plane-inflated, ca. 3 mm long, light brown or yellow, with short dorsal furrow running along entire width of seed and forked above, coat hard, cartilaginous, broadly dehiscent when ripe. Fl. June, Fr. July–August.

Rock crevices in subalpine and alpine belts, 3,000–4,000 m. – Centr. Asia: Pam.-Al. (Kugitang, Kugi-Frush, Dashti-Uzbek). Gen. distr.: Dzu.-Kash. (Pamir). Described from Chinese Turkestan. Type in Leningrad.

19. *R. songorica* N. Gontsch. in Tr. Bot. Inst. AN SSSR, ser. 1, II (1936) 243, cum tab. – *Rh. ketmentica* Lipsky, in herb. – Ic.: l. c. –

Crooked, branching, spinose shrubs ca. 1 m high; old branches with nearly black bark, young ones red- or gray-brown, finely hairy; buds inconspicuous; leaves fascicled on reduced branches and alternate on young shoots, coarsely coriaceous, glabrous, finely pubescent only at base and along petioles, grayish-green and slightly glossy above, yellowish beneath, often shiny, spatulate-lanceolate or spatulate-elliptic, (1)1.5–2.5(4) cm long, (3.5)6–10(15) mm wide, rounded or obtuse at apex, cuneate at base, entire and slightly rolled at margin, with strong midrib compressed above and protruding beneath and 4 pairs of inconspicuous lateral nerves; petioles short, up to 1 cm. Flowers infundibular-campanulate, ca. 2.5 mm long, with triangular-ovate calyx lobes, on short pedicels (2–3 mm long), 3–6 in fascicle; fruit globose, slightly succulent and black, or dryish brown and

compound of 3-4 segments 4-6 mm long, 2-4 together, on ca. 3 mm long pedicels; seeds oblong-ovoid, 3-4.5 mm long, brown, shiny, with dorsal cartilaginous-rimmed shallow furrow shortly forked above, coat hard, cartilaginous, pale yellow. Fl. April-May, Fr. July-September.

Dry pebbly and stony mountain slopes, xerophyllous shrubby formations, rocks, from 800 to 2,000 m. - Centr. Asia: T. Sh. (E.). **Gen. distr.:** Dzu.-Kash. (Kuldja). Described from Kuldja. Type in Leningrad.

Family XCVIII. **VITACEAE** * LINDL.

Flowers regular, bisexual or unisexual, in monoecious or dioecious plants; calyx small, saucer-shaped, more or less distinctly 4-5-lobed, rarely 3-7-toothed or lobed at margin; petals 4-5, rarely 3-7, spreading or recurved on flowering, often with apices inrolled, concrescent in shape of a cap, falling at blossoming, rarely (in genus *Leea*) connate and adnate to staminal tube at base; stamens 4-5, rarely 3, opposite petals, inserted at base of hypogynous disk, free or rarely filaments connate into a tube (genus *Leea*), anthers free or connate, short, opening by 2 longitudinal slits; ovary 2-, rarely 3-6-carpeled, sometimes more or less buried in hypogynous disk; disk usually goblet- or cup-shaped, notched or lobed at margin, rarely adnate to base of ovary, sometimes formed by solitary spherical glands often united into small ring; ovules anatropous, 2-1 in each cell; style very short, conical or thick cylindrical-conical, often elongate and filiform; stigma cup-shaped or dotlike, obscurely 2-lobed or distinctly 4-lobed; fruit usually a fleshy juicy berry, 2-1-(rarely 3-8)-locular; seeds 2-1 in each cell, with hard coat; endosperm hard, fleshy, fatty. Russian representatives of this family are exclusively shrubs, usually climbing by tendrils; leaves unusually variegated, with 2 lateral stipules at base, always alternate; inflorescences usually cymose, often paniculate, racemiform or spikelike, usually opposite the leaves.

Key to Genera

1. Petals 5(4), connate at summit, separating at base, deciduous, cap-shaped; hypogynous disk strongly spreading, deeply crenate; inflorescence elongate-paniculate, sometimes with tendril at base; bark of old branches splitting into longitudinal strips; pith of biennial branches yellowish-brown 878. *Vitis* L.
- + Petals not connate at summit, stellately spreading on flowering; inflorescence corymbiform-paniculate; bark of old branches not as above; pith of biennial branches white 2.
2. Ends of tendrils usually dilated disciformly, the suckerlike, hypogynous disk completely adnate to base of ovary but distinctly distinguished from the latter by its color 880. *Parthenocissus* Planch.

* Treatment by D. I. Sosnovskii.

- + Ends of tendril not as above; hypogynous disk saucer- or cup-shaped, distinctly separated from ovary . . . 879. **Ampelopsis** (Mchx.) Planch.

Subfamily 1. **VITOIDEAE** Gilg in E. u. P. Nat. Pflanzenfam. III, 5 (1896) 441.— Flowers (with few exceptions) 4–5-merous; petals on flowering connate at summit forming a cap, subsequently falling completely or spreading; stamens 4–5, free, not adnate to petals; style short or elongate-filiform; stigma inconspicuous, dotlike or dilated; ovary 2-locular with 2 ovules in each cell.

Genus 878. **VITIS** * L.

L. Sp. Pl., (1753) 202. — Spinovitis Romanet in Compt. Rend. Par. XCII (1881) 1096

676 Flowers in polygamous or dioecious plants or flowers bisexual with saucer-shaped obscurely incised or 5-lobed calyx; staminate flowers with filiform elongate stamens and abortive ovary; functional pistillate flowers with short recurved stamens and sterile pollen; petals 5, connate at summit forming a cap, all falling after blossoming; stamens 5; ovary 2-locular, with 5 glands more or less united at base into a ring; ovules two in each cell; stigma dotlike, inconspicuous; fruit a 2-locular fleshy juicy berry; seeds 2–4, with hard coat, more or less pyriform, more or less strongly tapering to base, ventrally with 2 pits, dorsally with orbicular chalaza inside a longitudinal furrow. Mainly shrubs, creeping by tendrils opposite leaves. Flowers in paniculate inflorescences, on peduncles often provided with tendril.

Note. In spite of the fact that the family Vitaceae, in comparison with many other families, has few taxa and might appear to give little cause for serious attention, it is still among the most difficult to treat and one of the least studied taxonomically. Many questions have remained highly disputable to the present day. In the first place it should be noted that even the complete composition of the family remains unclarified. Starting with Planchon (first monograph of the family) it was acceptable to divide Vitaceae into two subfamilies: Vitoideae and Leeoideae. The inclusion of the latter in Vitaceae is doubtful. The basic character compelling the investigators to include *Leea* in the family Vitaceae is the position of the inflorescences opposite the leaves; however, there are so many serious distinctions in the structure of the flower of *Leea*, in comparison with the other members of the family, that many of the investigators found valid reason to doubt that the genus belonged to this family and to consider separating it into a specific family. Moreover, some features of the habit of species of *Leea* (which are difficult to convey verbally), suggest certain similarities with some members of the family Araliaceae. All these complicated questions concerning the phylogenetic affinity of the subfamily Leeoideae to members of the family Vitaceae require immediate settlement.

* Name used by the ancient Romans for the grapevine.

A great deal of confusion is caused by the species composition of the genus *Vitis* and its interrelationships. Such problems cause obstacles in the taxonomy of *Vitis*, and the entire family Vitaceae. In spite of extensive investigation the species composition of *Parthenocissus* and its interrelationships continue to remain obscure; this is also the case with a number of other genera in the same family.

Unfortunately, there are few monographic studies on Vitaceae. *Vitis* has attracted the most attention because of its economically valuable species, in particular *V. vinifera* L. s. pr. The literature on this species is literally limitless, and yet it must be said that a wide array of elementary problems in its taxonomy remains unsolved to this day.

677 The study of both the taxonomy of the family in general and the taxonomy of the taxa in its genera, in particular of the central genus *Vitis*, is still incomplete.

These factors combined compel us to confine ourselves in the given treatment to the more important notions in the taxonomy of Vitaceae. Our aim is to stress the fundamental problems that must be resolved in future monographs on the family, with the application of methods used in taxonomic investigation of the most critical groups of the plant world.

Vitis is known in many localities in the USSR from the Upper Cretaceous to the Pliocene.

Vitis alaskana Cock. (cf.) in Oligocene Kamch. (Krutogorovo).—*V. cf. arctica* Heer in Upper Cretaceous Tsagayan Amur (Bureya Tsagayan).—*V. crenata* Heer in Upper Eocene deposits of Upper Due Sakh. (Pil'vo, Pyatyi Klyuch).—*V. macrophylla* Baik. in Sarmatian Transcarpathia (Berezinka).—*V. nathorstii* Krysht. in Miocene Uss. (Suifun).—*V. olrikii* Heer in Upper Cretaceous An. (between Omocha and Mys. Telegraficheskii).—*V. praevinifera* Sap. in Sarmatian Bl. (Krynka).—*V. sachalinensis* Krysht. in Upper Eocene Sakh. (Ogorodnaya).—*V. teutonica* A.Br. in Sarmatian Bl. (Amvrosievka).—*V. cf. teutonica* A.Br. in Miocene Irt. (Abrosimovka, near Tara).—*Vitiphyllum cf. naumannii* Nath. in Oligocene Sakh. (Cape Sernyi).

1. Leaves rather thick, flocculose-tomentose with brown or white hairs, later sometimes glabrous, glaucous beneath, never green above or beneath; shoots 5-angular 2.
- + Leaves generally less thick, glabrous or variously pubescent (hairs never brown), green above and beneath, more or less shiny 3.
2. Tendrils regularly arranged on stem, i.e., on each subsequent node; leaves rufous-brown beneath, nearly tomentose-hairy; berry medium-sized, 1.5 cm in diameter, with characteristic taste recalling that of blackcurrants 1. *V. labrusca* L.
- + Tendrils irregularly arranged on stem (absent in each third node); leaves usually deeply 3–5-lobed, cobwebby-tomentose with unequal reddish or gray hairs; fruit small (as big as a grain of pepper), lacking a unique taste 2. *V. thunbergii* Sieb. et Zucc.
3. Creeping, not climbing shrubs, with few thin tendrils or tendrils absent; leaves shorter than wide, petiolar incision usually broad and shallow; leaf lobes with little elongate tooth **V. rupestris* Scheele.
- + Climbing shrubs, with well-developed tendrils 4.

4. Flowers bisexual or functionally pistillate then with recurved short
 678 stamens and sterile pollen; seeds with rather long beak; petiolar
 incision of leaves usually narrow, often closed, acutely angular below
 3. *V. vinifera* L.
- + Plants dioecious, staminate flowers with long filaments and rudimen-
 tary ovary, pistillate flowers with recurved stamens and sterile pollen;
 seeds with short beak; petiolar incision usually broad, open, usually
 flat below 5.
5. Septa (diaphragm in nodes of mature shoots) thin; juvenile shoots not
 reddening; leaves longer than wide, ovate, shallowly lobed, leaf lobes
 terminating in long acute tooth **V. vulpina* L.
- + Septa (diaphragms) thick, compact; juvenile shoots more or less
 yellowish-red; leaves generally deeply lobed 6.
6. Annotinous mature shoots deeply ribbed; juvenile shoots more or less
 hairy, angular at cross section; leaves thick, dark or grayish-green,
 more or less hairy when young, mature leaves often dark-hairy beneath;
 leaf teeth usually short, apex of leaf usually short, usually
 rectangular, distinct **V. berlandieri* Planch.
- + Annotinous mature shoots not ribbed or slightly so; juvenile shoots
 usually orbicular at cross section or slightly angular. 7.
7. Petiolar incision open, arched, margins parallel or widening, orbicular
 below; seeds reddish, oval-globose, short; fall color of leaves very
 bright 5. *V. amurensis* Rupr.
- + Petiolar incision open, usually very broad, flat below; seeds whitish,
 oval or oblong-pyriform; fall color of leaves not as bright
 4. *V. silvestris* Gmel.

Section 1. EUVITIS Planch. Vignes americ. (1873) 102.— Bark striped-fibrous, later splitting; seeds pyriform.

Series 1. *Labruscae* Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 322.— Tendrils regularly arranged; cobwebby-velutinous, with more or less rufous hairs; berries large.

1. *V. labrusca* L. Sp. pl. (1753) 203; Grossg., Fl. Kavk. III (1932) 54; Negrul' in Ampelogr. SSSR, I, 82.— *V. vinifera* ♂. *labrusca* v. *americana* O. Ktze. in Tr. B.S. X (1887) 179.— *V. vinifera* ♂. *labrusca* v. *orientalis* O. Ktze. l. c. 178.— Ic.: Viala et Verm. Ampel. I (1910) pl. 3; Ampelogr. SSSR, I, tabl. XVII.

Climbing shrubs, vine half-robust, with stem 20–25 cm in diameter; root thick, fleshy; annotinous shoots dark chocolate in color, cylindrical, densely hairy; tendrils continuously arranged, shortly 2–3-partite; buds large, conical, sparsely covered with rusty hairs; stipules long, cordate;
 678 leaves large, broadly ovate or orbicular, 24–25 cm long, 15–17 cm wide, entire to obscurely 3-lobed, often notched with orbicular incisions, petiolar incision varying in depth and width, V-shaped, margin dentate with shallow mucronate incised teeth, surface more or less rugose, dark green, hairy when young, later glabrous; lower face densely pubescent, more or less

whitish when young, later rusty or brown. Inflorescence small or medium-sized, usually compound, racemes usually winged [?], dense, on thick short to medium-long peduncle; berry medium-sized, black, pink, rarely white, with thick epidermis and distinct bloom, with typical musky or "foxy" odor, 2-4-seeded; seeds with short beak, chalaza obscure, forming an oval concave-canaliculate suture. Fl. May-June, Fr. September. (Plate XXXVIII, Figure 1.)

Cultivated and frequently locally escaped in forests. — Caucasus: W. and E. Transc. (Kuba District), Tal. **Gen. distr.:** N. Am.: northeastern and eastern states of U. S. A. (from SW Canada to N. Carolina, Ohio). Described from America. Type in London.

Economic importance. Introduced from N. America into Europe at the beginning of the 19th century. On the initiative of M. N. Vorontsov, it was introduced into W. Georgia during the fifties of the last century and is now cultivated in Abkhazia, Megrelia and Guria under the name "Odessa" for light wines and table brands. Grown sometimes as an ornamental. It is noted for its high cold-resistance (in the Crimea and W. Georgia it withstands temperatures down to -30°C) and heat-resistance (withstands up to 40°), but cannot tolerate more than 10% lime in soil.

Its phylloxera resistance is higher than in *V. vinifera*, but is still low and hence it cannot be used as a stock. It is resistant to fungal diseases except for the black rot. Easily rooting. Closely related to *V. vinifera* L.

In the United States it is the basic stock for the cultivation of table and other wines and is also crossed with the American varieties of *V. aestivalis cordifolia* and the European vine *V. vinifera*.

This species is not always highly valued, as its berries when eaten in great quantity, cause irritation to the mucous membranes of the mouth.

Note. Locally escaped frequently in the forests of W. Georgia (Abkhazia, Megrelia, Adzharia) and also in Azerbaidzhan (Kuba District and Talysh). The form growing in Talysh was separated by O. Kuntze as a variety under the name "*V. vinifera* Labrusca v. *orientalis* O.Ktze." Kuntze was severely criticized for his position on the species and generic composition of the Vitaceae. The forms established by him are now a matter of historical interest and only encumber the synonymy. I. T. Vasilchenko regards *V. labrusca*, growing in the forests of Talysh, as a locally escaped population and separates it as the species *V. hyrcanica* Vass.

Series 2. **Labruscoideae** Planch. in A. et C. DC. Monogr. Phaner. V, 12 (1887) 323. — Tendrils interruptedly arranged. Pubescence cobwebby-velutinous, brownish or ash-gray.

2. *V. thunbergii* Sieb. et Zucc. Fl. Jap. Fam. nat. (1843) No. 412; Planch. in A. et C. DC. Monogr. Phaner. V (1887) 333; Kom., Fl. Manch'zh. III, 818; Kom. and Alis., Opre del. r. Dal'nevost. kr. II, 731; Negrul' in Ampelogr. SSSR, I, 125. — *V. labrusca* c. *ficifolia* et d. *sinuata* Rgl. in Tr. B. S. (1873) 3. — *V. vinifera* δ . *labrusca* l. *thunbergii* O.Ktze. in Tr. B. S. X (1887) 178. — Ic.: Rgl. Gartenfl. (1864) tab. 424, f. 3; Viala et Verm. Ampelogr. I (1910); *V. vicifolia* Bge. Enum. (1831) 12; Planch. l. c. 364 et 612; Ampelogr. SSSR, I, 125.

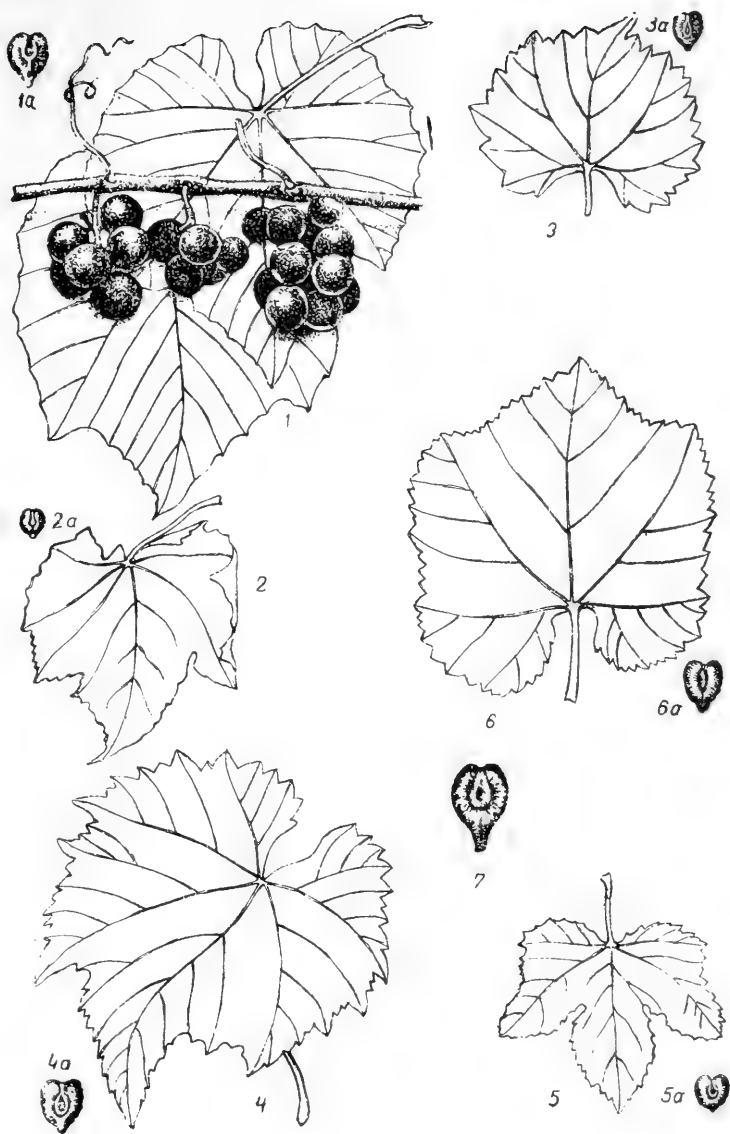


PLATE XXXVIII. 1—*Vitis labrusca* L.; 1a—seed; 2—*V. berlandieri* Planch., leaf; 2a—seed; 3—*V. rupestris* Scheele, leaf; 3a—seed; 4—*V. vulpina* L., leaf; 4a—seed; 5—*V. thunbergii* Sieb. et Zucc., leaf; 5a—seed; 6—*V. amurensis* Rupr., leaf; 6a—seed; 7—*V. vinifera* L., seed.

Weakly growing vines, with habit more reminiscent of a shrub than a climber, climbing on trees; shoots angular, early shoots cobwebby-flocculose; tendrils many, furcate, interruptedly arranged; leaves small, cordate, deeply 3–5-lobed, wider than long, averagely 6–10(14) cm long, lobes broadly ovate with orbicular notches, or short lobes and with acute notches, irregularly dentate with protruding mucronate teeth or lobes pinnatifid (and then notches wide), dark green, glabrous above, rusty-tomentose beneath or gray and finely cobwebby, hirsute on nerves. Inflorescences axillary, spreading, 5–8 cm long, shorter than opposite leaf or nearly as long, flocculose; racemes very numerous on one and the same branch; flowers in dioecious plants staminate and functionally pistillate; berries small, black, pruinose, 8–10 mm in diameter, with thick epidermis, 2–3(4-) seeded; seeds small, trihedral, convex at base, with very short beak and a faint furrow; chalaza oval, continuing as a suture. Fl. July–August, Fr. September–October. (Plate XXXVIII, Figure 5.)

Maritime cliffs. — Far East: Uss. **Gen. distr.:** Jap.-Ch. Described from Japan. Type in Leningrad.

Economic importance. Often grown in gardens of Europe because of its very showy, wine-red, autumn leaves.

- 683 Series 3. *Cinearscentes* Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 323. — Branches faceted; berries small; hairs flocculent or velutinous, more or less grayish.

★ *V. berlandieri* Planch. Compt. rend. Ac. Sc. Paris, 91 (1880) 425–428. — *V. monticola* Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 323, 341; Negrul' in Ampelogr. SSSR, I, 103. — Ic.: Viala et Verm. Ampelogr. I (1910) pl. 16, 17; Ampelogr. SSSR, I, tabl. XIX.

Climbing shrubs, partly robust vine; annottinous shoots grayish-brown, more or less angular, hairy, mature shoots flocculose, usually with short internodes; diaphragm thick; tendrils interruptedly arranged, long, large, 2–3-partite; stipules small; leaves rather large, nearly as wide as long (8–10 cm), blade broadly cordate, notched or shallowly 3-lobed blade, petiolar incision more or less open, V- or U-shaped, shallowly dentate at margins with broad teeth, more or less dark green and glossy above, grayish-hairy beneath when young, later becoming glabrous and even shiny except at nerves and ribs. Flowers in dioecious plants, staminate and functionally pistillate; racemes large, dense, compound, long-stalked; fruit small, black, faintly pruinose, succulent, slightly bitter but pleasant when fully ripe, juice faintly colored; seeds few, medium-sized or small, short, convex, oval or globose with short rostellum; chalaza oval or orbicular, distinct, suture narrow, somewhat discernible or obscure. Fl. June, Fr. September. (Plate XXXVIII, Figure 2.)

Cultivated. Escaped locally in N. America. **Gen. distr.:** N. Am. Described from Texas. Type in Paris.

Economic importance. The best phylloxera-resisting stock for dry, calcareous-stony soils. Vines grafted on *V. berlandieri* are outstanding for high and consistent harvests. The ripening of European varieties grafted on this stock is faster, and the sugar content of the berries is higher.

Introduced into Europe after 1887. Withstands to minus 22–28°C; at lower temperatures the plants do not ripen and freeze. Enduring temperatures up to 40–45°C. Phylloxera resistance is high, surpassing all the other American varieties in this respect. Its resistance to fungal diseases is very high. It is very tolerant of lime, enduring more than 0.5% in the soil.

684 The hybrids of *V. berlandieri* × *V. vinifera* tolerate 40–45% lime in the soil and those of *V. berlandieri* × *V. riparia* up to 25–40%. One shortcoming of this species lies in the difficulty of rooting its cuttings (10–15% success) under the usual methods of propagation by cutting. Its hybrids with *V. riparia* and *V. vinifera* yield easily rooting cuttings that are resistant to chlorosis and phylloxera.

Series 4. **Rupestres** Planch. in A. et C. DC. Monogr. Phaner, V, 2 (1887) 323.— Branches erect; tendrils few; hairs simple.

**V. rupestris* Scheele in Linnaea, XXI (1848) 591; Ampelogr. SSSR, I, 106.— Ic.: Ampelogr. SSSR, I, tabl. XX.

Small, strongly branching shrubs, sometimes partly climbing; diaphragm thin, somewhat thinner than in *V. riparia*; tendrils few, weak, usually falling or absent; leaves small, averagely 9 cm long, 6 cm wide, early leaves often plicate, broadly cordate or reniform, wider than long, faintly lobed, smooth, glabrous, later glabrous on both sides, petiolar incision broad and shallow, coarsely dentate at margin, often abruptly mucronate at apex. Flowers in dioecious plants, functionally pistillate and staminate; racemes small, 8–10 cm long; berries small but usually slightly larger than in *V. riparia*, dark violet, black or purple-black, 2–4-seeded; seeds small, 3.5–4 mm, not notched but usually forming a narrow furrow; chalaza medium-sized, pyriform, usually concave, sometimes very distinct. Fl. June, Fr. August. (Plate XXXVIII, Figure 3.)

Cultivated. Native to N. America. **Gen. distr.:** N. Am. Described from Texas.

Economic importance. An excellent stock for the European varieties of grape. The vines grafted on it are distinguished by their sturdy growth and easy rooting, even in poor, dry, stony soils. It was introduced into Europe around 1885 and is known for its resistance to cold, enduring without noticeable injury low temperatures of –28°C. For successful development it requires a good deal of warmth. Withstands continued drought. It is unusually resistant to phylloxera and fungal diseases, particularly mildew. Although it is very tolerant to soil conditions it cannot endure the smallest quantity of lime in the soil, with the exception of some forms, for example *rupestris* du Lot, which tolerates up to 18–20% soluble lime in soil. The latter form is of importance now as a stock. The cuttings are easily rooted. There is a marked affinity to *V. vinifera*. One of its unfavorable qualities is that the berries of the grafted European varieties lag behind in ripening and thus lower the quality of the harvest.

685 Series 5. *Cordifolio-Ripariae* Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 323. — Berries small or medium-sized; plants either short-bristly or cobwebby, with simple hairs; leaf with hair-tufts at angles of nerves.

**V. vulpina* L. Sp. pl. (1753) 293, s. str. et non auct. plur. — *V. riparia* Mchx. Fl. bor.-am. II (1803) 231. — *V. incisa* Jacq. in Hort. Schoenbr. IV (1804) 14. — *V. odoratissima* Donn. Catal. Cantab. ed. VI (1811) 62. — Ic.: Ampelogr. SSSR, I, tabl. XX.

Climbing shrubs, rather robust to very much so; anootinous shoots cylindrical or slightly angular, commonly smooth, thin; tendrils interruptedly arranged, thin, usually 2-partite, usually reddish; stipules large; leaves medium-sized (averagely 12.0×8.0 cm), thin, entire or 3-partite or the lower 5-partite, with shallow angular incisions, petiolar incision broad, usually shallow, acutely serrate at margin with incised teeth variously shaped, pale green and glabrous above, usually glabrous beneath or sparingly hairy along ribs and nerves. Racemes medium-sized or small, usually dense, cylindrical, winged [?], 10–15 cm long, short-stalked; fruit small, 7–9 mm in diameter, black or dark blue, pruinose, 2–4-seeded; seeds small, 4×2.5 mm, short, usually faintly notched, brownish-gray, with very short beak; chalaza obscure, narrowly oval, flat, suture usually furrow-like, sometimes nearly indiscernible. June. (Plate XXXVIII, Figure 4.)

Cultivated. Native to N. America. Gen. distr.: N. Am. Described from Virginia. Type in London.

Economic importance. A valuable stock for the European varieties of grape, one of which is *V. riparia* (Gloire de Montpellier). Favorite stocks are the hybrids of *V. riparia* with the American vines (for example, with *rupestris*, *berlandieri* and others) and also with some European varieties related to *V. vinifera* L. In Europe *V. vulpina* has been especially widespread as a stock since 1874. It is noted for its resistance to cold (withstanding frosts of -30°C) and endures temperatures of up to 40°C . It is sufficiently phylloxera-resistant and resistant to fungal diseases, especially mildew and oidium. It can be used as a stock only in deep, fertile, moist soils. Its productivity in lime is low (10–12%). In grafted varieties fruit-bearing and ripening of berries are faster. The grafted varieties bear fruit more abundantly in the first years, but with time the harvest falls and the soil needs strong manuring. The cuttings regenerate very easily. It is very closely related to *V. vinifera* L.

686 In crossing with the latter species a high percentage of hybrids resistant to mildew and oidium are obtained.

3. *V. vinifera* L. Sp. pl. (1753) 293; DC. Prodr. I. (1824) 633; M. B. Fl. taur.-cauc. I (1808) 174, III (1819) 169, p. p.; Ldb. Fl. Ross. I, 458, p. p.; Boiss. Fl. or. I (1867) 955; Rgl. in Tr. B. S. II, 2, 397–399; Shmal'g., Fl. I, 206, p. p.; Grossg., Fl. Kavk. III (1932) 54. — *V. vinifera* subsp. *sativa* (DC) Hegi, III. Fl. V. (1925) 365. — *V. vinifera* spontanea M. Pop. in Plodov. sredn. Tadzh. 7 (1935).

Shrubs up to 30(43) m high, with stem up to 1.5 m in circumference; bark usually peeling in strips, branches brown-red to brown-yellow, glabrous or simple-hairy or flocculose, thinly furrowed, nodes usually with

septom; leaves orbicular, pentagonal or reniform, entire, 3–5-lobed or dissected, sometimes nearly pinnatisect (var. *laciniosa* (L.) Asch.), 5–20 cm in diameter, usually with narrow acutely angular, sometimes closed petiolar incision, cordate at base, irregularly and usually obtusely dentate at margin, glabrous or short-hirsute or long cobwebby, sometimes pubescence mixed on individual plants, usually more hairy beneath, sparsely weak-hairy to tomentose. Flowers bisexual or functionally pistillate then with short recurved sterile stamens (purely staminate flowers rare, with stelliform-spreading corolla), arranged in compound loose or more or less dense panicles, sometimes with tendrils, racemes varying in shape, from cylindrical to cylindrical-conical, often winged [?]; fruit much variable, 6–22 mm long, globose, flattened, oval, elliptic, oblong, ovoid to obovoid or irregularly shaped (curved, with furrows at summit, etc.), much variable in color: black-violet, purple, dark red, pink, yellowish, green or greenish, with thick or mucilaginous juicy pulp, usually sweet or sourish; seeds 3–4, averagely 2(6–7) mm long, pyriform or ovoid, beaked, chalaza appearing at about upper third of seed, rarely seeds absent. Fl. May–June, Fr. August–September. (Plate XXXVIII, Figure 7.)

Cultivated (sometimes locally escaped) mainly in the European part: Bes., Bl., L. Don, L.V., Crim.; Caucasus: Cisc., Dag., W., E. and S. Transc.; Centr. Asia: southern regions. Native habitat unknown. Grown in Centr. Eur., Med., Bal.-As. Min., Arm.-Kurd., Iran., Jap.-Ch., N. Am., S. Am., Argentina, Chile, N. Afr. (Egypt), S. Afr. (Cape, Madagascar), Australia, New Zealand. Escaped locally: Cisc., Dag., Transc., Centr. Asia (T. Sh., Pam.-Al., Kopet Dagh).

687 Note. Among the older cultivated plants of Eurasia, the cultivation of grapes dates far back. The seeds found in the relics of the Swiss lake dwellings, the archaeological findings in Azerbaidzhan dating from the Paleolithic, etc., are striking evidence that viticulture is nearly as old as man.

We have proof today which shows without doubt that grape growing was introduced many thousands of years before the common era. The ancient Egyptian wall paintings and the Assyrian reliefs depicting the highlights in grape culture, the gathering of the harvest and production of wine, go back in history for more than 40 centuries. Oral poetry and the ancient literary monuments of the Mediterranean peoples have preserved the legends about this plant.

In the works of Cato, Varro, Columella, Pliny and others we learn of cultivation methods, grafting, selection, as well as ways to make wine. Grapes, and the wine obtained from them, were celebrated by the poets of classical Greece and Rome, and by the great poets of the East – Saadi, Omar Khayyam, and others. It is not surprising therefore that over the centuries man was influential in changing the natural features of the grape, transforming the external conditions of its existence, applying different methods of pruning and fertilizing and other agricultural measures, and extensively using artificial selection, intraspecies crossing, and vegetative reproduction so that in the process the cultivated grape gradually lost its identity and resemblance to the original forms. Owing to this human effort countless new varieties have emerged, now numbering from 4 to 5 thousand. In some cases they are hardly distinguished by their morphological characters, but they are distinct in taste, technical and ecological features. In many different parts of the globe, men sought to improve

and perfect the grape with the result that numerous local varieties were created. This culture affected and has been reflected in the psychology of man. In many countries viticulture acquired a specific direction. In some, the development centered on the wine grape, in others on the table varieties.

In their constant migrations from place to place, the peoples of the Mediterranean invariably took along, together with their domestic goods and chattels, the seeds of plants customarily cultivated by them. In this way viniculture and viticulture spread to other countries, varieties were created in the new settlements and new "blood" was poured into the
688 local grape, all of which led to further enrichment of the universal diversity of grapes.

Unfortunately, neither oral nor written records of the various stages of grape growing were preserved, except in a few cases, and hence the phylogenetic interrelationships between the different varieties and the connections with the parental forms have become more obscure. As a result, the whole colossal group of forms usually designated as *Vitis vinifera* L. s. str. within the Linnaean system represents a heterogenous aggregate of morphologically immensely variable taxa which at times are difficult to distinguish from each other.

There have been several attempts to construct a genetic classification in which all the diverse forms relating to the species *V. vinifera* L. s. proprio would be arranged in an orderly system, but up to the present time most of these attempts have turned out to be unsatisfactory. F. Kolenati's attempt at a classification on the basis of the character of the pubescence is not too convincing. There is no question that the pubescence is a very substantial character, but at the same time it is a very inconstant character of minor significance which helps to differentiate only certain varieties of grapes. In the last few decades two exceptional schemes were drawn, one of them by the noted Soviet expert, A.M. Negrul', and the other by the prominent Hungarian ampelographer, Andras. Despite the fact that both schemes were drawn from different points of view on the magnitude of *V. vinifera*, there are some similarities in them. Though neither scheme can be regarded as complete, it must be admitted that they represent a huge step forward in the elaboration of the genetic classification of the European grape. Andras submits that five basic species can be separated among the European forms: *V. mediterranea* Andras. (Mediterranean countries), *V. byzantina* Andras. (W. Asia), *V. alemannica* Andras. (C. Europe), *V. deliciosa* Andras. (W. Asia) and *V. antiquorum* Andras. (W. Asia). In Andras' opinion the whole varietal diversity of the Eurasian grape is derived from these five basic species and the subsequent crossings between them, not only between two but sometimes even between three species. Negrul' assumes that all the Eurasian cultivated forms belong to the one Linnaean *V. vinifera* ssp. *sativa* DC. Within the limits set by Linnaeus, he distinguishes three basic groups which he calls "proles." The first group — *proles pontica* Negr. — comprises the wine grape variety, with entire leaves, mixed cobwebby and hirsute hairs, dense racemes, rounded, rarely oval, juicy, rarely fleshy-juicy berry, small
689 or medium-sized. In this group are the wine varieties of Georgia, Asia Minor, Greece, Bulgaria, Hungary and Rumania. Negrul' divides this group

into subproles *georgica* Negr., which includes all the Georgian cultivars, and subproles *balcanica* Negr., which includes the cultivars of the Balkans. The second group — proles *occidentalis* — is characterized by small leaves with loose cobwebby pubescence, small compact racemes, and usually rounded small berry. To this group belong the high quality wine grapes of France, Germany, Spain, Portugal, and Italy. The third group — proles *orientalis* Negr. — is characterized by the glabrous or hirsute leaves, the large, often branching, loose racemes and the shape (oval, ovate, oblong, etc.) of the usually fleshy, small or medium-sized berry. Negrul' subdivides this group into two subproles: subproles *caspica* Negr. is characterized by rather large, often branching racemes and juicy berry. It comprises the large-fruited, mainly table grape of Central Asia, Afghanistan, Iran, Armenia, Azerbaidzhan and Dagestan; subproles *antasiatica* Negr. includes the firm, fleshy table grape of Azerbaidzhan, Dagestan and Turkmenistan. This group is widespread throughout the globe.

In a comparison of these schemes it is impossible not to find some similarity. Thus proles *pontica*, established by Negrul', is almost the same as *V. mediterranea* Andras.; proles *occidentalis* partly corresponds to *V. alemanica* Andras.; proles *orientalis* subpr. *caspica* apparently corresponds to *V. byzantina* Andras.; subpr. *antasiatica* more or less to *V. antiquorum* Andras. Negrul' and Andras disagree only with respect to the Muscats which Andras refers to *V. deliciosa* Andras. and Negrul' to the above-mentioned last subgroup as a variety (var. *apiana* Negr.)

The question of the origin of the cultivated Eurasian grape remains unsolved. Most of the investigators (De Candolle, Engler, Pachoski, Hegi, Negrul' and others) consider that the cultivated grape was derived from the locally escaped *V. silvestris*. Negrul', in particular, submits that the forms of the proles *occidentalis* originated from the form he distinguished as *Vitis vinifera* ssp. *silvestris* aberrans, with glabrous or hirsute, dissected leaves — which is still found growing in the forests of Kuba District in Azerbaidzhan.

The well-known German dendrologist, K. Kox, was of the opinion that the cultivated European grape was derived from the Amur *Vitis amurensis* Rupr. On the other hand, some investigators were convinced that the cultivated Eurasian grape evolved from several species. This opinion was already held by Planchon.

One of the first to express this view was Regel, considering at first, 690 like Kox, that one of the parents of the Russian grape was the Amur species, but later proposing that the Russian grape was the result of the crossing of different varieties of the American species *V. vulpina* and *V. labrusca*. Andras' views have already been given above.

In our view, it seems highly improbable that the cultivated Eurasian grape was directly derived from the locally escaped *V. silvestris* Gmel. This latter species is a morphologically well-defined species, sufficiently differentiated from *V. vinifera* L. s. pr., extremely polymorphic, with its own history, independent area of distribution and occupying a very specific place in the plant communities of river valleys. The presence in the staminate flower of *V. silvestris* of the rudimentary ovary, combined with the fact that the pistillate flower of this species is only functionally

pistillate, leads us to the conclusion that the unisexuality and dioecism of *V. silvestris* is a secondary phenomenon. We cannot agree with Negrul' who maintains, as does Ratai, that the unisexuality of the cultivated grape is the result of the selection of male vines of *V. silvestris* on which bisexual branches accidentally appeared. In our view, the ancestors of the species of *Vitis* (including *V. silvestris*) had bisexual flowers and the unisexual developed as a result of the reduction in the process of evolution. Negrul' himself does not deny the possibility of such a development of dioecism in the contemporary species of *Vitis*.

We feel that thus far there has been no convincing proof that the cultivated Eurasian grape originated directly from *V. silvestris*.

Far more convincing is the suggestion that both *V. silvestris* and *V. vinifera* s. str. developed independently from some now extinct bisexual ancestors who were later completely dissolved in diverse strains of the cultivated grape. It is quite possible that the cultivated grape developed from several species, including crossing with *V. silvestris*. This view in its final form was presented by Academician V. L. Komarov, who thinks that the cultivated grape developed from now extinct, wild ancestors and that it is a species created by man (Komarov, *Proiskh. kul't. rast. izd. 2* (1938) 194). This point of view was first expressed by S. I. Korzhinskii in 1910.

There is no doubt in our minds that *V. vinifera* s. pr. belongs to the number of those cultivated plants whose real ancestors were never established and that it was created by man. It is common knowledge that such plants are not few.

691 The question of the native country of the cultivated grape also evokes lively discussion. Most of the investigators (Hayne [?], Engler, and others) are inclined to regard Southwest Asia as the original place.

Hayne in particular studied the literature in an attempt to trace the gradual movement of cultivated grapes from the East to Greece, the Roman Empire and Gaul. There is another point of view which maintains that viticulture originated independently in different countries within the present borders of distribution in Eurasia. We personally concur with this point of view.

In the course of many years the attention of Soviet investigators has focussed on grapes growing under natural conditions in Central Asia. These grapes are basically characterized by characters typical for the cultivated grape (*V. vinifera*) — large berries, usually sweet in taste, white, rarely black, and leaves glabrous or hirsute underneath; their assemblage of characters is close to the group of forms separated by Negrul' under the name *proles antasiatica* Negr. Certain investigators were inclined to regard this group as an independent species and one of the ancestors of the cultivated grape. M. G. Popov noted, for example, that the grapes of Tadzhikistan, which he separated under the name "*V. vinifera* var. *spontanea*", had been the precursor of the glabrous-leaved, table variety of Central Asia.

G. P. Sumnevich and I. T. Vasil'chenko have recently been occupied with the spontaneous vines in Central Asia. Sumnevich concludes that a special, indigenous species of grape, which he calls "*V. schrederi* Sumn. (nomen nudum)" (G. P. Sumnevich, *Dikii vinograd zapadnogo Tyan'shanya*. Sovetsk.

Bot. XXXI, 1 (1946) 46), is growing in Central Asia. Vasil'chenko goes still further in this respect. He separated a species from Gissar Range under the name "V. hissarica Vass." (I. T. Vasil'chenko, K voprosu o proiskhozhdenii kul'turnogo vinograda. Refer. n.-issl. rabot za 1945 g. Otd. Biol. nauk AN SSSR (1947) p.6).

Vasil'chenko recently described a number of species related to the above (Sovetsk. Bot. XV, 6 (1947) 341-342): *V. pistacioides* Vass., *V. schischkinii* Vass., *V. subacerifolia* Vass., *V. bosturgaiensis* Vass., *V. usunachmatica* Vass., *V. tanghimuri* Vass., *V. lapilloides* Vass. We were able to study Vasil'chenko's material. In our opinion all the "species" enumerated are none other than the escaped forms of the cultivated *V. vinifera* s. propr. We are in full agreement with the conclusions drawn by Baranov and Negrul' with regard to the wild derivation of the "locally escaped" Central Asian grape.

692 Economic importance. In the USSR grapes are a highly valuable crop and of enormous economic significance in agriculture and industry. They provide the basis of domestic viniculture and are grown for food.

The northern border of the wine grape in the USSR stretches from Kamenets-Podol'ski (48°40'), Tul'chin in the south from Uman (48°30'), Kirovograd (48°40'), turning up the Don and reaching Pyatizbyanskaya (48°35'), then across the Volga to Krasnoarmeisk from which it extends south to Astrakhan. From here the border crosses to the mouth of the Ural up to Gur'ev (48°15'). Along the slopes of the right bank of the Volga the border reaches the latitude of Balashov (52°3'). In Central Asia it extends from Gur'ev to the upper reaches of the Sumbar River in the Turkmen SSR and then up to Kizyl-Arvat (39°5'), passing through Ashkhabad (38°), Merv (37°50'), Chardzhui (39°), Staraya Bukhara (39°55'), Chimkent (42°30'), (42°30'), Aulie-Ata [now Dzhambal] (42°50'), Frunze (42°50'), Alma-Ata (43°15'), Zaisan District, proceeding to W. China. According to 1937 data, the general area covered with vineyards in the USSR was about 209,000 ha. At present this area has enlarged considerably with the inclusion of Bessarabia in the USSR and its increase elsewhere. The largest industrial areas for viniculture in the USSR are in the Moldavian SSR, the southwestern part of the Ukraine, the Azov-Black Sea Territory ([former] Stalingrad Region), the Crimea, N. Caucasus, Dagestan, Georgia, Azerbaidzhan, Armenia, Uzbek, Turkmen and Tadzhik SSR.

At present endeavors are centered on expanding the northern areas to the Voronezh, Kursk, Smolensk, Moscow, Ivanovo, Gorki, Kirov, Kuibyshev, Saratov and other regions in the USSR, including the Bashkir ASSR.

In addition to the successful cultivation of the main European commercial varieties, plenty of high quality local wine and table varieties are under cultivation on Soviet territory, particularly in the Caucasus and Central Asia. The Transcaucasian Republics are especially rich in valuable local wine varieties, Georgia taking the first place with over 300 local varieties of the popular table wines. Among the latter such commercial varieties of Kakhetia as "rka-tsiteli," "mtsvane" and "saperavi" are most popular. Also popular are some varieties from W. Georgia, which are excellent for the production of light table wines. The best known of these are "tsitska," "krakhuna," "dolikauri," "aleksandrouli," and others. At present the trend in Georgia is to try to produce chateau wines from high

693 quality, selected varieties. Armenia is famous for its dessert and strong table wines. Famous local varieties are "khardzhi," "mokhali," "chilar," "kakhet" and others. Armenia is also known for its table varieties including the valuable "khardzhi," "askyari," "marmori," "khalabash" and others. In Azerbaidzhan the most valuable local varieties are "kara-shirai" ("matrasa") and "bayan-shirai." Of the table varieties the most famous are derivatives of the Iranian "tavriz."

Central Asia is famous for its table varieties of which the most important are "nimrang," "charao," "khusaine," different kinds of "kishmish" (seedless) and others.

Of importance in northern viniculture are the varieties introduced by the brilliant innovator I. V. Michurin, who crossed the European grape with the Amur. Many of these varieties are recommended from the commercial point of view. They include the seedless "malengra," "russkii konkord," "buitur" and others.

The basic product yielded by the grape is wine. From the distilled wine grape brandy, grape vodka and alcohol are produced. By-products in all wine-growing areas are vinegar and aldehyde.

Grapes are also used as food both in their natural and in their processed forms. Different non-alcoholic beverages, such as grape juice and syrup are made of them. The seedless grapes are dried. The berries are used in jams, juice, concentrated juices, marinades, and are canned as flat cakes rolled in dough (tklapi). The juice is used in the making of marmelade, churchkhel (an Eastern delicacy), etc. In the Caucasus the young vine leaves go into the making of "dolmy" (stuffed vine leaves). They are eaten salted in the winter.

The roasted seeds are sometimes used as a substitute for coffee.

The fruits of such varieties as "shasslya," "khardzhi" and others are known for their medical value. They are used with success in the treatment of anaemia, metabolic disturbances, stomach and kidney ailments, etc.

The by-products obtained in viniculture and viticulture are broadly utilized in industry and agriculture.

Thus, oil is extracted from the seeds, containing an average of 53.0% linolein, 35.9% olein, 5.2% palmitin, 2.2% stearin, and 1.6% non-saponifying substances. The oil is eminently suitable in food and is sold in Germany under the name "vasko." It is also used in the manufacture of soap. A
694 second pressing yields fuel oil.

The by-products of viniculture are tartaric acid, cream of tartar, potassium tartrate and calcium, antimonyl potassium tartrate (potassium bitartrate), potassium sodium tartrate, etc., applied in the polygraphic, chemical, confectionery, textile, silver-nickel and also in defense industries. The residues mixed with lime are fed to cattle and used as a fertilizer. Tannin is extracted from the stalks after separating the berries.

The residue of the variety "saperavi" of over-fermented wine is boiled and used in Kakhetia to dye silk different hues of lilac. Annotinous shoots are used to dye wools a dark brown color.

In the First World War the Germans used the young tendrils in the textile industry. The material remaining from vine cuttings is used in making a medium quality paper as well as charcoal.

The berries contain 0.25–1.25 (in mg-%) vitamin B₁, traces of vitamin B₂ – 0.006. The content of vitamin C varies from 0.43 to 12.3 mg-% per wet weight, depending upon the variety. The leaves contain from 110 to 150 mg-% per wet weight of vitamin C, which is completely suitable for the preparation of concentrates of vitamin C.

The planting of vineyards is of great importance in reclaiming sandy deserts and semideserts and also to fix moving sands.

Finally, grape vines are ornamental in gardens as trellises, latticework, arbors, etc.

The main shortcoming of the European grape is its lack of resistance to phylloxera. Because of this the area of natural root vineyards decreases from year to year and should be replaced by new plantings grafted on different, more resistant species, varieties and hybrids of American vines. On the other hand for a long time there have been attempts to cultivate the so-called "straight producers" – phylloxera-resistant varieties obtained by crossing the European varieties with the American grape and a subsequent selection. However, the results achieved in these experiments were unsatisfactory due to the poor quality of the fruits from these varieties.

The Russian grape vine shows unusually meager resistance to fungal diseases. Mildew (*Plasmopara viticola*), oidium (*Oidium tuckeri*) and anthracnose (*Gloeosporium ampelophagum*) are the main pests of vineyards.

695 The control of these pests calls for systematic and tenacious work which demands great losses of time and money.

The editors think it more probable that the origin of the cultivated grape is polyphyletic, i. e., originating not from *V. sylvestris* Gmel., but from a series of locally escaped species widely distributed from the W. Mediterranean and N. Africa to Kashmir and Fergana, as S. I. Korzhinskii assumed. From the material available it is impossible to approach this problem more precisely. Nevertheless, the provisional data in this direction published by Andras (see below) and Vasil'chenko are noteworthy.

For this reason, the editors think it useful to present the Key to the "micro" species of grapes proposed by Andras (see Magyar Flora (1924)) among the cultivated types of this plant, and usually united under the name *V. vinifera* ssp. *sativa* (DC.) Rgl.

It should be noted that this Key (based on Andras' data but given in an abridged form) is of use only for orientation in the complex of cultivated grapes since he did not examine extensively the diversity of forms in the USSR and adjacent countries in the south. Moreover, Andras could not precisely determine *V. vinifera* sensu stricto and hence some of his species should possibly be referred to the synonymy of *V. vinifera*.

A similar Key is given for the wild-growing species of grapes as observed by Vasil'chenko, most of which were earlier referred to *V. vinifera* ssp. *sylvestris* (Gmel.) Rgl. The Keys are given separately because it was not always possible to find a clear-cut distinction between the cultivated and wild species on the basis of the available material. This complicates the appropriate naming of cultivars which are continuously being introduced from the wild grape; sometimes the name of the old cultivated

variety appears with the addition of some epithet (for example, "Cabernet domestic," etc.). The grafting and sexual hybridization of the wild and cultured grape are also causing complications in the nomenclature.

Much more work is required in collecting and studying the material, as well as revision of the data (Keys) below which were summed up by Vasil'chenko based on Andras' (cultivated species) and on his own investigations (wild-growing species).

Key to Cultivated Species of Grape (*V. vinifera* S. L.)

1. Leaves tomentose beneath, hairs dense and thick, whitish and gray; berries rounded. Mediterranean. Mediterranean varieties (for example, "Murvel," "Morastel," etc.) . . . *V. mediterranea* Andras.
- + Leaves with different pubescence or glabrous; berries rounded or elongate (oval, oblong-oval, etc.) 2.
2. Developed (adult) leaves elongate, distinctly longer than wide; berries rounded, sweet. W. Asia. Variety type "Shasla," etc. ("table grape") *V. byzantina* Andras.
- + Developed (adult) leaves not elongate, as long as wide or even wider than long; berries rounded or more or less elongate (see above), bitter-sweet or sweet 3.
3. Berries medium-sized or small, rounded, bitter-sweet ("wine variety"); racemes small or medium-sized, cylindrical, dense, short-stalked. C. Europe — domestic wine variety ("Traminer," "Riesling," etc.) *V. alemanica* Andras.
- 696 + Berries oblong or ovate, sweet; racemes medium-sized or large, branching, loose ("table variety") 4.
4. Developed leaves slightly wider than long, deeply 5-lobed, acutely toothed, median lobe adjacent to lateral lobes; berries with strong "muscat" taste, usually yellow or yellowish-green. W. Asia ("Muskat") *V. deliciosa* Andras.
- + Developed leaves approximately as long as wide; median lobe not adjacent to lateral lobes; berries without "muscat" taste, often more or less curved, white, red, lilac, etc. W. Asia ("Cornichon"). *V. antiquorum* Andras.

Key to the Wild-Growing Species of Grape (*V. vinifera* S. L.)

1. Flowers various: in some plants (vine) pistillate with abortive stamens (filaments twisted and recurved below, pollen sterile), on another staminate (with erect filaments and fertile pollen), with abortive ovary; leaves glabrous, cobwebby or tomentose beneath; berries small (5–10 mm), globose, bitter, sour or bitter-sweet; seeds with short rostellum, obovate 2.
- + Characters other than above 5.
2. Leaves tomentose beneath. Trans., Crim., N. Iran *V. hyrcanica* Vass. (in Sov. Bot. 6 (1947) 341).
- + Leaves glabrous beneath or pubescence different 3.

3. Leaves spreading-(bristly) hairy beneath, especially along nerves.
Transc. *V. trichophylla* (Kolen.) Vass.
(*V. vinifera* ssp. *trichophylla* Kolen.) (in Sov. Bot. 6 (1947) 342).
- + Leaves glabrous or more or less cobwebby-hairy beneath. 4.
4. Seeds convex bilaterally. Crim.
. *V. taurica* Vass. (in Sov. Bot. 6 (1947) 340, Figure 2, 1).
- + Seeds ventrally more or less flattened, dorsally convex. Caucasus
(W.?), Centr. and S. Eur., As. Min. (?), N. Iran. (?), Kopet Dagh (?)
. *V. sylvestris* Gmel. (Fl. Bad. I (1805) 543).
5. Berries elongate, oval-oblong or asymmetrical-oval, etc., longer than
wide 6.
- + Berries globose or ovoid-globose, as long as or nearly as long as wide
. 7.
6. Seeds broadly obtriangular, large (7 mm long), gray. Centr. Asia,
Gissar Range
. *V. pistacioides* Vass. (in Sov. Bot. 6 (1947) 341, Figure 2).
- + Seeds obpyriform, small
. *V. usunachmatica* Vass. (in Sov. Bot. 6 (1947) 342, Figure 2, g).
7. Leaves spreading-hirsute beneath along nerves. Centr. Asia, Kara-
Tau (Bos-Turgai)
. *V. bosturgaiensis* Vass. (in Sov. Bot. 6 (1947) 342).
- + Leaves glabrous or cobwebby-hairy beneath 8.
8. Rostellum of seeds short (0.75–1 mm long) 9.
- + Rostellum longer or seeds dimorphous: with long and short beaks in
the same berry 11.
9. Leaves very large (up to 15–18 cm in diameter), glabrous beneath,
green, glossy. Centr. Asia: Fergana Range
. *V. subacerifolia* Vass. (in Sov. Bot. 6 (1947) 341, Figure 2).
- + Leaves not as large, more or less cobwebby-hairy beneath 10.
10. Seeds dark red, 5 mm long, ca. 4 mm wide, with 0.75–1 mm long
rostellum distinctly separated from "body" of seed. Centr. Asia:
Chatkal
. *V. schischkinii* Vass. (in Sov. Bot. 6 (1943) 341, Figure 2).
- + Seeds gray-brown, 5–6 mm long, 3–4 mm wide, gradually tapering to
1 mm long rostellum. Centr. Asia: Gissar Range
. *V. hissarica* Vass. (in sb. ref. n.-issl. rabot za
1946 g. Otd. biol. nauk AN SSSR (1947); Sov. Bot. 6 (1947) 340, Figure 2).
11. Seeds big, angular, like small pebbles, 6–7 mm long (including the
thick, 1.5–1.75 mm long beak), 4–5 mm wide. Centr. Asia: Gissar
Range . . . *V. lapilloides* Vass. (in Sov. Bot. 6 (1947) 342, Figure 2).
- + Seeds dimorphous: elongate (7 mm, including 1.5 mm long beak, 3 mm
wide) and more thickened (6 mm long, 4 mm wide, including ca.
0.75–1 mm long beak) in same berry. Centr. Asia: Gissar Range. . .
. *V. tanghimuri* Vass. (in Sov. Bot. 6 (1947) 342, Figure 2).

Note. In this species the leaves are sometimes spreading-hairy be-
neath along nerves.

4. *V. silvestris* Gmel. Fl. Bad. I (1805) 543; Grossg., Fl. Kavk. III, 54.— *V. vinifera* auct. plur. quoad pl. spontaneam; L. Sp. pl. (1753) 293; M. B. Fl. taur.-cauc. I, 174, III, 169; Ldb. Fl. Ross. I, 458; Shmal'g., Fl. I, 206.— *V. vinifera anebophylla* Kolenati in Bull. Soc. nat. Mosc. (1846) 286.— *V. vinifera trichophylla* Kolenati, l. s. 287.— *V. vinifera α. sylvestris* DC. Fl. Franc. V (1815) 857; Planchon in A. et C. DC. Monogr. Phaner. I, 356.— *V. vinifera silvestris* Doell, Rhein. Fl. (1843) 686; Hegi, Ill. Fl. V, 364.— *V. vinifera* ssp. *silvestris* Beck, Fl. v. Nied. Oest. II (1892) 532.— *V. vinifera δ. labrusca v. silvestris* (Doll.) O. Ktze. in Tr. B. S. X (1887) 179.— *V. hederacea* Huot. in Demid. Voyage, II (1842) 208, non Ic. Viala et Vermor. Ampelogr. I (1910) pl. 40 (sub *V. vinifera*).— Ic.: Negrul' in Ampelogr. SSSR, I, tabl. IX–XII.— Exs.: Fl. exs. austr.-hung. No. 2032; Fl. exs. Bohem.-Sloven. No. 860. No. 860.

698 Shrubs; bark grayish-brown, narrowly striate; leaves 5(8–9) cm long, orbicular, oval or subreniform across, subentire or faintly incised, more often 3- or 5-lobed, petiolar incision usually very broad, rarely narrow, open, obtuse, rarely acute, upper lobe slightly elongate, usually shortly broad-triangular, upper incisions shallow, hardly discernible to well-developed, largely and irregularly acutely toothed at margin, rarely teeth rounded, variously pubescent: cobwebby, hirsute or with mixed hairs, mostly beneath, rarely leaves glabrous; flowering racemes up to 15 cm long, loose, branching, on 4–7 mm long peduncles; petioles hirsute or subglabrous. Flowers in dioecious plants; berries (6)7–8(10) mm long, black, with glaucescent-bluish bloom, rarely white, epidermis thick, pulp delicate, with colorless or slightly colored juice; seeds 1–4 in berry, small, 3.5–6 mm long, 3–4 mm wide, ovoid, grayish-reddish or grayish red-brown, rarely rufous-reddish, beak up to 1 mm long; chalaza on broad seeds suborbicular, on narrower slightly oval, distinctly concave or nearly flat, raphe distinct with narrow marginal furrows, straight or slightly curved. Fl. May, Fr. September. (Plate XXXIX, Figure 1.)

River valleys up to 1,500–1,800 m. — European part: Bes., Bl. (western part), Crim. (S.); Caucasus: Cisc., Dag., W., E. and S. Transc.; Centr. Asia: Mtn. Turkm. **Gen. distr.:** Atl. Eur., Med., Centr. Eur., Bal.-As. Min., Arm.-Kurd., Iran. Described from Germany. Type was in Berlin.

Note. Knowledge of the forms of wild grape growing in Eurasia convinces us that we are dealing here with only one species, albeit very polymorphic. We were unable to determine any significant differences between the forms growing in the Dnieper area, Crimea, N. Caucasus, Transcaucasia and Central Asia. Polymorphism within the species of *V. silvestris* is fairly extensive, but the forms do not have definite distribution areas. Taking this into consideration, it would serve no useful purpose to split this species or even subdivide it into varieties.

In investigating the intraspecies diversity of *V. silvestris* close examination of its forms in nature at both blossoming and fruiting times is required.

The most trustworthy character differentiating *V. silvestris* from the locally escaped plants of cultivated grape is its dioecism. The forms with bisexual flowers reported by some authors, for example the one observed by Negrul' for the Kuba District of Azerbaidzhan, are very probably

just escaped forms of the cultivated grape. The form of wild grape with bisexual flowers, though distinguished by closed petiolar incisions (reported by Borovikov and Zotov for the Dnieper area) also are doubtful in this respect.

Another important distinction of the wild from the cultivated grape is the broadly open petiolar incision, usually with flat bottom, but this character is apparently variable.

The wild grape is also distinguished from the cultivated one by the smaller measurements of all organs, including the fruits. The examined fruits were unusually globose in shape and usually blue-black in color. White berries have been observed but only as an exception. They are very sour in taste although occasionally sweeter ones have been found. Unfortunately fruit-bearing vines of *V. silvestris* are not frequent in Transcaucasia because probably the clusters of wild grapes are picked by the people long before they ripen.

The racemes are variously shaped, often winged [?], very loose, and readily disintegrate.

The leaves display the same basic variations of the cultivated vines and the Amur grape. Predominant among them are forms with dissected or slightly dissected or 3-lobed blades, less frequent are forms with 5-lobed blades. Our observations do not corroborate the reports of some authors, that the male specimens of *V. silvestris*, in comparison with the female, are distinguished by greater division of the blade. This requires more proof.

There is no doubt that *V. silvestris* is an independent species of grape, notwithstanding the theory of some authors, that it is only a wild form of cultivated grape.

I. T. Vasil'chenko described within *V. silvestris* the variety *dzharylgatschensis* Vass. from Dzharylgach, distinguished by its low habit (Sov. Bot. XV, 6 (1947) 339). He separated the Crimean population, with its bilaterally convex seeds, into the species "*V. taurica* Vass." (l. c. 340). We maintain that the forms related to the *V. silvestris* group can in no way be considered as independent species. Though extensively variable, *V. silvestris* is still recognized as a single species by many authors.

Economic importance. Although many specialists (Lazarevskii, Merzhanyan, and others) consider the wild grape to show little resistance to phylloxera and fungal diseases, this question remains far from definitively resolved. The fact that wild grapes grow successfully within the immediate vicinity of vineyards located in areas markedly infested with phylloxera calls for re-examination of the wild grape—phylloxera relationships. Study of the roots of the wild grape by K. I. Iluridze of the Botanical Institute of the Academy of Sciences of the Georgian SSR revealed that the roots of some forms are anatomically like the typical root "*rkatsiteli*" — one of the most phylloxera-resistant varieties in Kakhetia. The same can be said of fungal diseases. Undoubtedly, the wild grape might be infested by all the main fungal diseases affecting the cultivated grape, but not to the same extent as those cultivated in W. Georgia, grown by the so-called "*maglari* method," i. e., climbing on trees. There is

every reason to presume that the wild grape displays a relative resistance to fungal diseases. Otherwise, many of the vines in Transcaucasia would inevitably have died long ago because of the double effect of fungal diseases and phylloxera.

In addition to other qualities, the wild grape also possesses a high degree of resistance to cold and drought, as has often been proved.

All these factors provide an indication that the wild grape could be of definite interest to the selector as material for cultivating hot- and cold-resistant varieties manifesting a definite resistance to phylloxera and fungal diseases. It crosses very easily with different cultivated varieties as evidenced by the many crossings observed both in nature and in the artificial pollination of the functionally female varieties with pollen of the wild grape (which can be seen, for example, in the Khanlar District of the Azerbaidzhan SSR and in the Bolnisi District of Georgia).

The unripe marinated fruits of wild grape are very popular among the Armenian people (Pambak district) as a food seasoning. According to Negrul' (Ampelogr. SSSR, I, 197), from the berries of *V. silvestris* a very good wine is produced in the southern regions of the USSR. Unfortunately, he does not provide the precise localities.

5. *V. amurensis* Rupr. in Pl. Maak. (1859) 524; Kom., Fl. Man'chzh. III, 14; Kom. and Alis., Opre del. r. Dal'nevost. kr. II, 734; Rehd. Man. cult. trees (1940) 610; Negrul' in Ampelogr. SSSR, I, 118. — *V. vinifera* β. *amurensis* Rgl. Tent. Fl. Uss. (1861) 36. — *V. vulpina* δ. *amurensis* Rgl. in Tr. B. S. II, 2 (1873) 394–395. — *V. thunbergii* Rgl. in Gartenfl. 34 (1864) tab. 424, non Sieb. et Zucc. — Ic.: Rgl. Gartenfl. (1861) tab. 339; Ampelogr. SSSR, I, tabl. XXIII.

Shrubs; or woody climbers; trunk up to 12–15(18) cm thick, stems up to 15 cm thick; up to 15 (and more) m high; bark black, peeling; fertile shoots 60–300 (and more) cm long, 5–15 mm thick, erect, suberect or spreading, green or red in summer, yellow-brown or red-brown in fall, orbicular at cross section, angular; leaves orbicular and cordate or broadly cordate, very rarely just regularly orbicular, 16–18 cm in diameter [?], dark green and dull, light pink in summer and dark pink in fall, simple, 9–22 cm in diameter, hairy above, shortly hirsute beneath on nerves and between them, rugose, 3–5-lobed, petiolar incision open, arcuate, with parallel or diverging margins and rounded bottom, upper incisions usually open, with nearly parallel margins rarely closed, rounded at base, sometimes acuminate, serrate with teeth acute or rounded-triangular, the terminal elongating into a cusp, large; main nerve 10–17 mm long; petioles 5–15 cm long, 3–3.5 cm thick, with anthocyanin, red-, rarely yellow-brown in the fall, orbicular, with shallow furrow at one side, slightly tomentose. Flowers in dioecious plants; pistillate inflorescences branching, conical or cylindrical-conical, rhachis 9–15 cm long, 10–17 mm thick, rarely tomentose; stamens 5, rudimentary, recurved, with sterile pollen; staminate inflorescences varying in shape, rhachis 7.5–12 cm long, 1.5–2.5 mm broad, rarely tomentose; stamens 5(7), 2.5–3 mm long, pistil rudimentary; racemes cylindrical, cylindrical-conical, rarely conical, winged, usually loose, rarely dense, 10–25 cm long, 2–1 on shoots, peduncles usually herbaceous or partly woody, green or with anthocyanin, 2.5–4 cm long, 2.1–2.7 mm thick; fruit-bearing stipe 5–10 mm long, 1–2 mm thick, barbed, tuft of hairs pale yellow, 2–2.5 mm long, not falling; berries usually

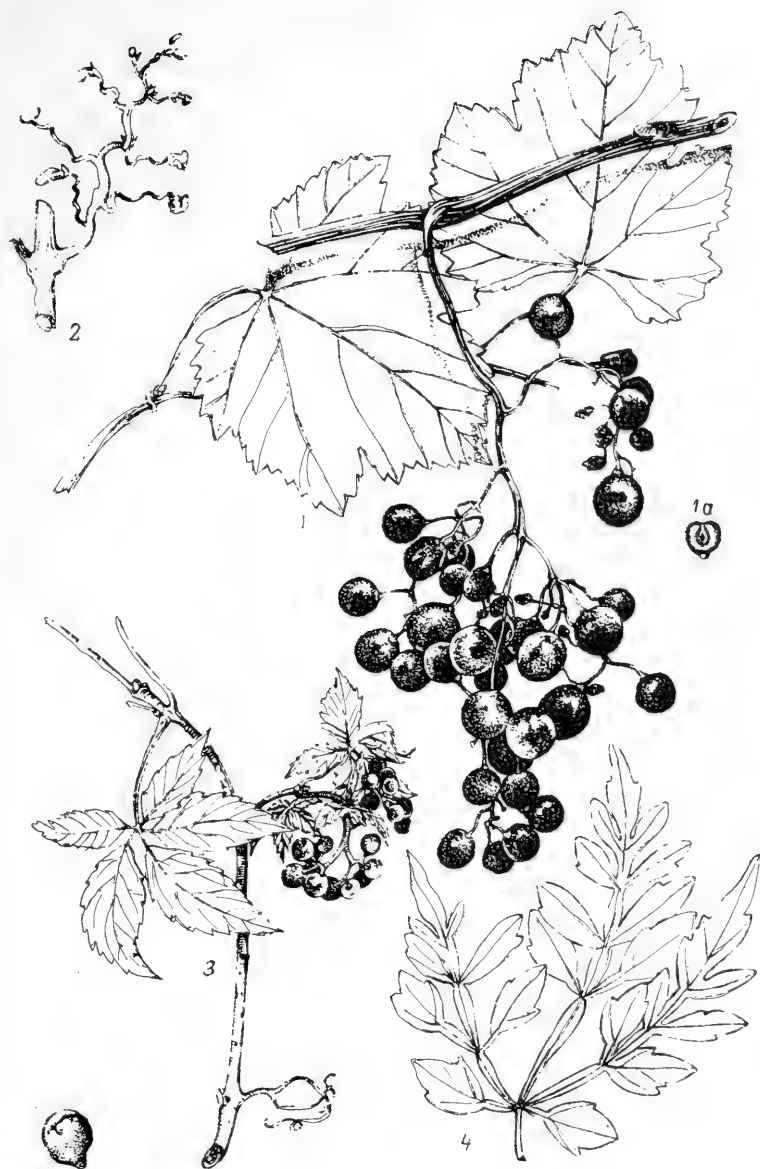


PLATE XXXIX. 1 - *Vitis silvestris* Gmel.; 1a - seed; 2 - *Parthenocissus quinquefolia* (L.) Planch., tendril; 3 - *P. inserta* (Kern.) A. Fritsch., seed; 4 - *Ampelopsis japonica* (Thnb.) Makino, leaf.

orbicular, black with strongly bluish bloom, 15–18 mm, 8–12 mm in diameter, epidermis thick, colored, separating from pulp, pulp fleshy-juicy, bitter or rarely sweet to taste, colorless, juice colorless; average weight of raceme 35–40 g; seeds 1–4 in a berry, pink with lilac tinge, lilac with yellow tinge, bordeaux with brown tinge, pale brown with pink tinge, pure bordeaux and dark brown, pyriform, rarely broadly or oblong-pyriform, chalaza usually oval, beak conical, short, rarely cylindrical, split at tip. Fl. May–July, Fr. August–September. (Plate XXXVIII, Figure 6.)

Sandy shores of rivers and islands, edges and clearings of cedar forests, shrubby thickets, rocky slopes. — Far East: Ze.-Bu., Uss. Gen. distr.: Jap.-Ch. (N. Manchuria). Described from Amur. Type in Leningrad.

Economic importance. For many years the fruit has been used to make conserves, jellies, juice, and also eaten fresh.

Wine of medium quality can be made from the grapes and alcohol should be added to it. The plant is of value as stock for grapevines because of its high cold-resistance. It can be successfully crossed with different varieties of grape. Work in this direction was started at the beginning of this century by I. V. Michurin who created valuable grape hybrids by crossing the given species with *V. labrusca* L. M. I. Tikhonov also performed crossings with different American species at the Suifun-Ussuri fruit-growing station. Some of the shortcomings of the Amur grape lie in its easy susceptibility to mildew and lack of resistance to phylloxera.

- 704 Considering how easily the Amur grape crosses with the American varieties, its resistance to mildew and phylloxera can be acquired in such a way. An ornamental plant, highly winter hardy.

The best economically significant forms should be cultivated.

Vitis amurensis × *Kaempferi* — *V. pulchra* Rehd.

Genus 879. **AMPELOPSIS** * Mchx.

Mchx. Fl. bor.-am. I (1803) 159; Planch. in A. DC. Monogr. Phaner. V (1887) 453

Plants polymamomonoecious, often the outer flowers appearing bisexual; calyx inconspicuous; petals 5, stellately spreading in flowering; stamens 5; disk cup-shaped, emarginate-4–5-lobed, adnate to base of stamens; style elongate-filiform; stigma inconspicuous, entire; fruit baccate, 2–4-seeded, brightly colored, encircled at base by persistent annular rudiments of disk, disk subentire at margin but with 4 shallow notches, often distinctly differing in color; seeds subovoid, smooth; chalaza linear-spatulate, with a small pit on each side, tapering to a filiform suture at back of seed. Creeping shrubs with tendrils opposite leaves, never broadening at apex to form suckers; leaves much differing in shape. Inflorescences opposite leaves, branching, without tendrils.

The genus *Ampelopsis* was identified mainly from findings of seeds. *Ampelopsis* sp. in Aquitanian Ob (Tomsk).

* From the ancient Greek *ampelos*, grapevine; literally, having the habit of grapevine.

1. Leaves very deeply 3-5-lobed with more or less pinnatipartite median lobe, or palmate with more or less pinnatisect terminal leaflets; petiole of terminal leaflet and petiolules of lateral ones irregularly winged. 4. *A. japonica* (Thnb.) Makino.
- + Leaf lobes not pinnatipartite; rhachis not winged.
2. Leaves variable in shape, partly shallowly 3-lobed, partly deeply 3-5-lobed, with more or less orbicular incisions between lobes 3. *A. heterophylla* (Thnb.) Sieb. et Zucc.
- + Leaves more or less equal on individual plants, entire or shallowly 3-5-lobed 3.
3. Leaves completely entire or slightly lobed; shoots sparsely hairy only at early stage 1. *A. vitifolia* (Boiss.) Planch.
- 05 + Leaves entire to more or less distinctly 3-(5-) lobed, with acute incisions between lobes, acutely toothed at margin; shoots usually hirsute 2. *A. brevipedunculata* (Maxim.) Trautv.

1. *A. vitifolia* (Boiss.) Planch. in A. DC. Monogr. Phaner. V, 2 (1887) 454-455. — *Cissus vitifolia* Boiss. Diagn. ser. 1, VI (1845) 31. — *Ampelopsis aegiophylla* Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 454; C. K. Schn. Handb. Laubhbk. II, 318. — *Cissus aegiophylla* Bge. in Mém. St.-Petersb. VII (1851) 231 et in Al. Lehm. Reliquiae bot. (1843) 55; Boiss. Fl. or. 1, 956; Fedch., Rast. Turkest. 568. — *Vitis aegiophylla* Boiss. Fl. or. I (1867) 956. — *V. persica* Boiss. Fl. or. I (1867) 960; Rehder, Man. of cult. trees (1927) 608.

Shrubs; completely glabrous plants, slightly glaucescent, without tendrils; shoots erect, cylindrical, weakly striate; leaves short-petiolate, broadly deltoid, 4-7 cm wide, broadly cuneate or somewhat truncate at base but not cordate, entire or obscurely angularly 3-lobed, irregularly coarsely dentate at margin with acute triangular teeth, main nerves 3 (very rarely one of the lateral nerves 2-parted nearly to base). Inflorescence on 3-5 cm peduncle, opposite to and shorter than leaf; fruit small, as big as a grain of pepper, globose, black-blue, 2-3-seeded; seeds triangular-subovoid, dorsally convex, with keel and 2 small pits below; suture ovate at ventral side (on beak), at dorsal side proceeding to a rather broad, obovate-orbicular, slightly protruding chalaza.

Dry stony slopes, taluses, gravelly river-beds and rubbish heaps from 850 to 1,300-1,500 m. — Centr. Asia: Pam.-Al. Gen. distr.: Iran. Described from S. Iran. Cotype in Leningrad.

2. *A. brevipedunculata* (Maxim.) Trautv. in Tr. B. S. VIII (1883) 176; Koenhe, Dendrol. 400; Rehder, Man. cult. trees (1940) 617, p. p.; Kom. and Alis., Opredele. r. Dal'nevost. kr. II, 734. — *A. heterophylla* var. *amurensis* Planch. in A. DC. Monogr. Phaner. V, (1887) 456. — *A. cordata* Mchx. Fl. bor.-am. I (1803) 153; DC. Prodr. I (1824) 633. — *Cissus brevipedunculata* Maxim. Prim. Fl. Amur. (1859) 68. — *C. ampelopsis* Pers. Syn. I (1805) 142. — *Vitis brevipedunculata* Dipp. Laubholzk. II (1892) 564. — *V. cordata* C. Koch. Dendrol. I (1869) 554. — *V. heterophylla* var. *α. cordata* Rgl. in Tr. B. S. I (1873) 392.

Shrubs; robust plants with more or less yellow-red and hirsute juvenile shoots; leaves coriaceous, dark green and sparsely hairy above, pale green beneath, slightly shiny, broadly ovate, slightly cordate at base, 6–12 (averagely 10) cm long and wide, entire to more or less distinctly 3-(5-) lobed, median lobe more or less attenuate, longer than lateral, mucronate, lateral lobes rather spreading, broadly triangular-ovate, more or less acuminate, all coarsely serrate at margin; petioles as long as blade or shorter, more or less pubescent. Inflorescence a broad corymbiform panicle, nearly as long as leaf, on hairy peduncle 1.5–3.5 cm long; fruit 6–8 mm in diameter, pale lilac to blue, sometimes bright green, rarely whitish; seeds oboval. Fl. July–August, Fr. September–October.

Along small rivers entwined with shrubs.— Far East: Uss. Gen. distr.: Jap.-Ch. Described from Ussuri. Type in Leningrad.

3. *A. heterophylla* (Thnb.) Sieb. et Zucc. in Abh. der Math.-Phys. Cl. zu München (1846) 147; Kom., Fl. Man'chzh. III (1905) 20; Kom. and Alis., Opredel. r. Dal'nevost. kr. II (1932) 734.— *Ampelopsis brevipedunculata* var. *maximoviczi* Rehd. Man. of cult. trees (1927) 608 et (1940) 617.— *A. humilifolia* Bge. Enum. pl. Chinae bor. (1831) 12.— *Vitis heterophylla* Thnb. Fl. Jap. (1784) 103; Rgl. in Tr. B. S. II, 2, 392.— *Cissus humilifolia* Rgl. Ussuri, No. 108.— Exs.: G. R. F. No. 2354 (var. *bungei* Planch.).

Climbing tendrillous shrubs; shoots glabrous or the juvenile more or less sparsely-hairy; tendrils 2-partite; leaves commonly 5–10 cm long and wide, dark green above, bright green beneath, shiny, variable in shape, orbicular-ovate, partly shallowly 3-lobed, some 3–5-lobed on same shoot, remotely notched at margin, coarsely crenate-dentate, cordate or rounded or slightly truncate at base; glabrous beneath or more or less hairy along nerves; petioles up to 5 cm long, more or less pubescent or glabrous, slightly reddish. Inflorescence corymbiform, many times furcate, 3–8 cm wide, on up to 7 cm long peduncle; fruit 8–10 mm in diameter, light blue, punctate with darker dots. July.

Along small rivers.— Far East: Uss. Gen. distr.: Mong., Jap.-Ch. Described from Japan.

4. *A. japonica* (Thnb.) Makino in Bot. Mag. Tokyo, XVII (1903) 113; C. K. Schn. Handb. Laubholz. II, 320; Kom. and Alis., Opredel. r. Dal'nevost. kr. II, 734.— *A. serjaneaefolia* Bge. Enum. pl. Chin. bor. (1831) 12.— *A. napaeiformis* Carr. in Rev. Hortic. (1870) 17.— *A. tuberosa* Carr. Ic. 17.— *Paulinia japonica* Thnb. Fl. Jap. (1874) 170.— *Vitis serjaneaefolia* Franch. et Sav., Enum. pl. Jap. II (1879) 316; Kom., Fl. Man'chzh. III, 22.— Maxim. in Mel. Biol. IX, 149.— Ic.: Rgl. in Gartenfl. (1863) 3, tab. 531.

Climbing shrubs; root tuberiform; shoots glabrous, striate; tendrils few, usually simple; leaves more than 12 cm long, subcoriaceous, shiny above, glaucescent beneath, palmately compound of 5 (rarely 3) leaflets, outer leaflets variously 3-lobed or cuneately incised, sometimes entire, 707 shorter, the inner and the median pinnatisect or palmatisect, with cuneate, 3-lobed segments, upper leaflet 4–10 cm long, with articulate-winged petiole,

remotely coarse-dentate at margin; petioles 1–6 cm long. Inflorescence furcately branching, on weak, often furcate peduncle 3–8 cm long; fruit small, 5–7 mm in diameter, light violet-blue, punctate small, darker dots, 1–2-seeded. Fl. July–August, Fr. September–October. (Plate XXXIX, Figure 4.)

Mountain slopes, shrubby thickets, dry riparian terraces. — Far East: Uss. **Gen. distr.:** Mong., Jap.-Ch. Described from Japan. Type in Holland.

Genus 880. **PARTHENOCISSUS** * Planch.

Planch. in A. DC. Monogr. Phaner. V, 2 (1887) 446. — Psedera Necker, Elem. Bot. I (1790) 158. — Ampelopsis L. C. Rich. in Michx. Fl. bor.-amer. I (1803) 159, p. p. — Quinaria Raf. Amer. Man. of Grap. Vin. (1830) 6, non Lour

Flowers bisexual or the outer bisexual then actually some of them functionally staminate; calyx cup-shaped, incised–5-lobed; petals 5, spreading in flowering, very rarely connate at summit, falling after flowering like a cap; stamens 5, inserted under disk, disk glandular, completely adnate to base of ovary, not definite at margin, but readily distinguished in color and anatomical structure from ovary; ovary gradually tapering to short thick style; fruit baccate, 1–3-seeded; seeds globose, sometimes obtusely keeled at ventral side. Shrubs, climbing with tendrils, branches often disciform broadening at tips forming suckers; flowers in tendrill-free inflorescences in axils or opposite leaves.

Parthenocissus identified thus far only from findings of seeds.

Parthenocissus sp. in Aquitanian Ob (Tomsk).

Cissus described from Upper Cretaceous to Sarmatian.

Cissus atlantica Ett. in Sarmatian Transcarpathian (Uzhgorod, Mukachevo). — C. cockerellii Krysht. et Baik. in Upper Cretaceous Amur (Bureya-Tsagayan). — C. insularis Heer in Oligocene Sakh. (Mgachi; not Cretaceous?). — C. spectabilis Heer in Oligocene (not Cretaceous?) Sakh. (Mgachi). — C. kolyomensis Krysht. in Upper Cretaceous Okh. (Silyap River). — Cissus sp. in Oligocene Uss. (Nikolaevskii mine). — Cissites uralensis Krysht. in Upper Cretaceous Ar.-Casp. (Kul'dzhen-Temir). — C. inaequantibus Jarm. in Upper Cretaceous Ar.-Kasp. (Kara-Tau, Kizil-Dzhar). — C. kryshtofovichianus Jarm. in Ar.-Kasp. (Espe-Sai). — C. prodromus Krysht. in Upper Cretaceous Uss. (Suchan district).

- 708 1. Leaves 3-lobed, rarely ternate or entire 1. **P. tricuspidata** (Sieb. et Zucc.) Planch.
+ Leaves palmately compound with (3)5–7 leaflets 2.
2. Juvenile shoots green in spring; leaves with 5, rarely 3 leaflets; tendrils with 2–5 branches not broadening at tips like suckers or slightly broadening 2. **P. inserta** (Kern.) K. Fritsch.
+ Juvenile shoots light yellow in the spring; leaves with 6–7 leaflets; tendrils with 5–12 branches distinctly broadening at tips forming suckers; inflorescences at ends of branches
..... 3. **P. quinquefolia** (L.) Planch.

* From the ancient Greek partenos — virgin and cissos — ivy. Name given by Planchet as translated from the French vigne vierge.

Section 1. PALAEOCISSUS Koehne et Graebn. in Gartenfl. LI (1900) 248.— Leaves partly entire, partly 3-lobed, sometimes ternate.

1. *P. tricuspidata* (Sieb. et Zucc.) Planch. in A. et C. DC. Monogr. Phaner. V (1887) 452; Graebn. in Mitt. Deutsch. Ges. 40 (1928) 3; Rehd. Man. cult. trees (1940) 620.— *Ampelopsis tricuspidata* Sieb. et Zucc. Fl. Jap. Fam. nat. I (1843) 88–89.— *Quinaria tricuspidata* Koehne, Deutsche Dendr. (1893) 393; Kom., Fl. Man'chzh. III, 818; Kom. and Alis., Opredel. r. Dal'nevost. kr. II, 734.— *Psedera tricuspidata* Rehder in Rhodora, X (1905) 29; C.K. Schn. Handb. Laubholzk. II, 315.— *Vitis inconstans* Miq. in Ann. Mus. Bot. Lugd.-Bat. I (1863–1864) 91.

Shrubs; strongly branching tall plants climbing with numerous short branching tendrils, broadening at apex into disklike suckers; leaves of sterile shoots orbicular-ovate, 10–20 cm wide, crenate-serrate at margin or 3-lobed to nearly trifoliate; leaves of fertile shoots subcoriaceous, shiny, usually long-petioled, cordately 3-lobed, coarsely serrate at margin, lobes mucronate. Cymes forked, usually paired, much shorter than petioles; disk adnate to base of ovary, slightly inflated at margin, nearly 6-lobed; berry 1–2-seeded, bluish-black, pruinose 6–8 mm long; seeds subglobose or pyriform, with short acute beak; chalaza oblong, tapering to linear suture. Plant climbing up vertical granite walls of seashore.— Far East: Uss. (only in Pos'tet District). Gen. distr.: Jap.-Ch. Described from Japan. Type in Florence.

Economic importance. Sometimes cultivated in gardens as an ornamental plant. According to many authors the common cultivated *P. weitchii*, distinguished by simple, coarsely crenate leaves and proposed by some as an independent species, is merely one of the garden forms of *P. tricuspidata*.

Section 2. EARINOCISSUS Graebn. in Gartenfl. XLIX (1900) 249.— Apices of summer shoots light green; first flowers appear in spring or beginning of summer; tendrils usually 2–4-branched; suckers weakly developed or absent and therefore plants weakly climbing or attached by tendrils.

2. *P. inserta* (Kern.) K. Fritsch. Excurs. Fl. Oesterr. ed. 3 (1922) 321; Rehder, Man. of cult. trees (1940) 619.— *P. vitacea* Hitchcock, Key Spring Flora Man. (1894) 26.— *P. quinquefolia* Graebn. in Gartenfl. XLIX (1900) 250, non Planch.— *P. spaethii* Graebn. in Gartenfl. XLIX (1900) 250, non Planch.— *P. dumetorum* Rhed. in Sarg. Trees and Shrb. I (1905) 187.— *Ampelopsis inserta* A. Kern. Pflanzenl. I (1887) 658.— *A. hederacea* DC. v. *dumetorum* Focke in Abh. Naturf. Ver. Bremen, IV (1875) 550.— *A. quinquefolia* v. *vitacea* Knerr. in Bot. Gaz. XVIII (1893) 70.— *Psedera vitacea* Greene in Leaf. Bot. Observ. I (1906) 220.— *Quinaria quinquefolia* Koehne in Gartenfl. XLI (1893) 402, non Raf.— *Cissus quinquefolia* Sims. in Bot. Mag. (1824) tab. 2443.

Climbing shrubs, up to 3 m tall; juvenile shoots green; bark yellowish-gray; tendrils with 3–5 branches, very rarely with broadening disks at apex; leaves palmate, with 5, rarely 3 leaflets; leaflets elliptic or ovate to oblong, 5–12 cm long, mucronate, usually cuneate at base, coarsely and acutely serrate at margin, dark green above, shiny, brighter beneath, glabrous. Inflorescence furcately branching, on 3–7 cm long peduncle, drooping in fruit; fruit bluish-black, usually slightly pruinose, ca. 8 mm in diameter, 3–4-seeded; seeds grayish-brown, broadly cordate. Fl. June–July, Fr. July–August. (Plate XXXIX, Figure 3.)

Usually grown in gardens. Cultivated in gardens in most parts of the USSR. Originated in N. America. Described from N. Am. Type in London.

Economic significance. A favorite climbing ornamental, beautifying verandas, facades, summer houses and as trellises.

Section 3. *OPORINOCISSUS* Koehne et Graebn. in Gartenfl. XLIX (1900) 249, 274.— Flowering in late fall; tendrils with 4–12 branches; disks very strongly developed at tips of tendrils.

3. *P. quinquefolia* (L.) Planch. in A. et C. DC. Monogr. Phaner. V, 2 (1887) 448; Rhed. Man. cult. trees (1940) 619.— *Hedera quinquefolia* L. Sp. pl. (1753) 202.— *Ampelopsis quinquefolia* Mchx. Fl. bor.-am. I (1803) 160.— *A. hederacea* DC. Prodr. I (1824) 633.— *Psedera quinquefolia* Greene in Leaflet. Bot. observ. I (1906) 220.— *Vitis quinquefolia* Lam. Ill. II (1793).— *V. hederacea* Ehrh. Beitr. VI (1792) 85; Willd. Sp. pl. I (1800) 1183.

Climbing shrubs; juvenile shoots reddish; tendrils with 5–8 branches, upper ones shorter, with disciform broadenings at tips; leaves palmately compound; leaflets elliptic to obovate-oblong, 4–10 cm long, mucronate, usually cuneate at base, coarsely crenate-serrate with abruptly acuminate teeth, dark green above, glaucescent, dull beneath, short-petioluled. Inflorescence usually paniculate; fruit bluish-black, slightly pruinose, 6 mm in diameter, usually 2–3-seeded; seeds more or less cordate. Fl. July–August, Fr. September–October. (Plate XXXIX, Figure 2.)

Cultivated in gardens in most parts of the USSR. Originated in N. America. Described from N. Am. Type in London.

Economic importance. As in preceding species.

Genus 846a. **SKIMMIA** Thunb.

Thunb. Nov. Gen. III (1783) 57

1. *S. repens* Nakai in Tok. Bot. Mag. LXI (1927) 505; Sugawara, Fl. Saghal. III, 1253.— *S. repens* var. *typica* Mak. in Journ. Jap. Bot. VIII (1932) 17.— *S. japonica* auct. fl. Sah. non Thunb.— Ic.: Sugawara, l. c. tab. 576.

Procumbent shrubs with ascending glabrous green branches, 30–50 cm high; leaves winter-persistent, shiny, green, nearly whorled; petioles 5–15 mm long; blade lanceolate, entire or obscurely toothed, 2–8 cm long,

0.7–3 cm wide. Inflorescences terminal; staminate flowers [inflorescences?] ovate, 3 cm long; flowers with calyx lobes triangular, like petals ca. 1 mm long; anthers orbicular; pistillate inflorescences up to 2 cm long; pistillate flowers with petals ca. 3 mm long, white; ovary ovate, with short style and disciform stigma; drupe red, globose, 8–9 mm long. Fl. June–July, Fr. September.

Forests. — Far East: Sakh. (in the south and S. Kurile Islands).
Gen. distr.: N. Jap. Described from Hondo. Type in Tokyo.

DIAGNOSES PLANTARUM NOVARUM
IN TOMO XIV FLORAE URSS COMMÉMORATARUM
DIAGNOSES OF NEW SPECIES MENTIONED IN VOLUME XIV

Martio 1949

GERANIUM L.

1. *G. ferganense* Bobr. sp. n. (Subsect. *Collina* Knuth).

Perenne, (15) 25—40 cm altum ad *G. Meeboldii* Briquet valde accedit, habitu tamen differt. Rhizoma crassum descendens apice interdum ramosum, caules 1—2 et folia 3—5 emittens; folia radicalia longe petiolata, petiolis 15—25 cm longis, superne dense, inferne laxe pilis brevibus reversis obsitis; lamina 4—6 cm lat. subtus secundum venas praesertim breviter adpresseque pilosa, ambitu pentagono-orbiculata, non profunde usque ad medium (vel profundius) fissa, lobis latis ambitu obovatis vel rhomboideis, late inciso tri-dentatis; folia caulina circumscriptione pentagona, superiora minora subtrilobata; caulis in parte media dichotome ramosus, quod habitum proprium plantae adjicet; pedunculī breves, pedicelli ca. 1 cm long. quo facto flores ad aices ramorum magis minusve conferti; flores 3—4 cm diam. petalis pallide colorantibus. Floret junio.

Habitat in regione silvatica et subalpina montium Tjan-Schan in jugis Ferganico et Czatkalense.

Typus: Fergana septentrionalis, in trajectu Aflaton 8 VII 1908, leg V. Rovinsky; in Inst. Bot. Ac. Sc. URSS asservatur.

Haec species differt a *G. Meeboldii* Briquet folliis non profunde (usque ad medium) fissis sublobatis ambitu pentagonis lobis late inciso dentatis; a *G. saxatili* Kar. et Kir. et *G. colino* Steph. differt floribus ad apices ramorum confertis similitudinem inflorescentiae formantibus.

LINUM L.

2. *L. jailicola* Juz. sp. n. (§ *Protolinum*).

Caules haud alti, 12—25 cm alt.; folia valde conferta suberecta et imbricatim sese tegentia, breviora et relative latiora quam in *L. nervoso* W. K., 0.5—3 cm lg., 1.5—6 mm lt. apice acumine carentia vel breviter acuminata. Inflorescentia haud ramosa vel parum et breviter ramosa contracta; flores 1—5 in numero, relative parva; sepala breviter, 5—6 mm lg. et relative lata, breviter acuminata; petala ca. 1.5 cm lg.; sepala in planta fructifera capsulae longitudinem haud vel vix superantia. Caeterum *L. nervoso* W. K. simile, cujus prolem localem sistere videtur.

Habitat: in Tauria, in pratis et pratulis montanis et in declivibus jugi Jaila.

* [This appendix has been reproduced photographically from the Russian original.]

Typus speciei: ex jaila Ai-Petri in Inst. Bot. Academiae Scientiarum URSS asservatur.

Species non satis nota cum *L. nervoso* W. K. et *L. Aucheri* Planch comparanda et ulterius (et praesertim in cultura) examinanda.

3. *L. macrorhizum* Juz. sp. n. (§ *Adenolinum*).

Radix perennis verticalis valde robusta lignescens, apice reliquias caulium emortuorum anni praecedentis gerens. Caules floriferi saepe numerosi atque caespitem densam formantes (1) 4—20 in numero, 8—27 cm lg. erecti vel saepius decumbentes vel fere prostrati, stricti vel saepius basi curvati, tenues, rigidiusculi, teretes, siccatione leviter sulcati, inferne violascentes cicatricibus foliorum delapsorum notati, caeterum pallide virescentes, sat crebre superne subremote foliati apice tantum corymbuloso-pauciramosi vel subsimplices. Folia 3—15 mm lg., 0.5—1.75 mm lt. suberecta lineari-lanceolata uninervia, apice acutiuscula vel acuta, margine laevia, in planta sicca convoluta. Inflorescentia valde depauperata e floribus 1—5 constans floribus initio approximatis, post anthesin sat remotis. Flores mediocres homostyli. Pedicelli calyce 2—4-plo longiores, fructiferi elongati infimi ad 1.8 cm lg. Sepala ca 3.5 mm lg. 2—3 mm lt., late ovata vel ovato-rotundata dorso nervis prominentibus 5 percursa obscure (fere nigrescenti) viridia, exteriora 3 anguste albo-membranacea, apice sensim acutata vel acuminata, interiora 2 margine late albo-membranacea apice subito ex rotundato breve et rigidiuscule mucronata. Petala 10—16 mm lg., 6—8 mm lt. sepalis subquadruplo longiora obovata apice rotundata sicca obscure coerulea basi in unguem cuneiformem flavescens attenuata margine sese ut videtur paullo supertergentia versus basin coalita ipso basi libera. Stamina ca. 5—6 mm lg. (supra basin floris) antheris 1—1.5 mm lg. Styli longitudinem staminum aequantes vixve iis longiores, post anthesin autem conspicue ea superantes, filiformes stigmatibus capitellatis. Capsula ca. 6 mm lg., 4.5 mm in diam. calycem suū duplo superans ovoidea apice acuminata flavescens vel pallide brunnes-cens ad valvarum connexionem striis obscure viridibus vel fere nigricantibus longitudinaliter percursa. Semina ca. 4.5 mm lg. 2 mm lt., anguste ovata, obscure brunnea nitescentia.

Habitat: in declivibus lapidosis montium pamiroalaicarum imprimis in Tadzhikistania.

Typus e Tadzhikistania in Inst. Bot. Acad. Sc. URSS asservatur.

Affinitas: Affine *L. pallescenti* Bge. a quo tamen optime distinguitur radice crasso et robusto, caulibus numerosioribus saepe decumbentibus, floribus majoribus, petalis obscure coeruleis necnon loco natali.

4. *L. mesostylum* Juz. sp. n. (§ *Adenolinum*).

Bienne vel perenne; radix subverticalis, debilis vel sat robusta, plerumque paullo flexuosa, sublignescens, albescens. Caules floriferi plerumque pauci 1—7 in numero, 18—60 cm lg., plerumque erecti vel interdum basi

- 15 paullo curvati caeterum stricti tenues vel plerumque sat robusti, rigidi, teretes, in planta sicca laevisime vel sat conspicue sulcati, inferne cicatricibus foliorum delapsorum inter se remotiusculis notati, glaucescenti pallidivirides, plerumque sat crebre (superne saepe sat remote) foliati, paullo supra medium vel in triente superiore (initio florendi tantum apice) subcorymbosi ramosi ramis haud numerosis erecto patentibus strictis in planta fructifera valde elongatis. Folia 0.4—3 cm lg., 0.5—2.5 mm lt. plerumque erectopatentia linearia vel lineari-lanceolata uninervia vel inferne subtrinervia, apice obtusiuscula vel obtusa saepe mucronulata vel interdum (imprimis superiora) acuta, margine laevia, in planta sicca saepissime convoluta, ut videtur glaucescenti-viridia. Inflorescentia plerumque \pm multiflora e floribus 6—32 composita floribus initio \pm approximatis post anthesin valde remotis. Flores mediocres ca. 2.5 cm in diam., homostyli. Pedicelli calyce $1\frac{1}{2}$ —4-plo longiores suberecti, fructiferi 1—1.8 cm lg. elongati attamen saepius breviusculi leviter curvati vel plerumque declinati basi arcuati caeterum fere patentes. Sepala ca. 3—4 mm lg., 2—3 mm lt., sat late ovati dorso nervis prominentibus 5 percursa obscurascenti glauco-viridia, 3 exteriora anguste, interiora late albomembranacea, exteriora apice obtusiuscula vel breve acutata, interiora apice rotundata brevissime mucronulata. Petala ca. 9 mm lg., ca. 7 mm lt., sepalis subtriplo longiora obovata vel sat late obovata apice rotundata coerulea basi in unguem cuneiformem albescentem vel flavescenstem attenuata versus basin coalita ipso basi libera. Stamina ca. 0.5 cm lg. supra basin floris, antheris 1 mm lg. Styli longitudinem staminum subaequant, filiformes, basi connati, stigmatibus capitellatis. Capsula ca. 6 mm lg. et lt. calycem sesqui ad subduplo superans late ovoidea apice rotundata vel paullo acuminata straminea vel pallide brunnescens, ad sulcos lineis obscure brunneis saepe per ursam. Semina ca. 4 mm lg., ca. 2.5 mm lt., ovata obscure brunnea, paullo nitescentia.

Habitat: in montibus Tianshan occidentalis necnon in montibus pamiroalaicis.

Typus ex Okur ad Aksu (Angren), ab A. Regel lectus, in Herb. Instituti botanici Ac. Sc. URSS asservatur.

Affinitas: bene differt a *L. violascenti* Bge., cui proximum foliis latioribus, floribus coeruleis neque violascentibus. A *L. amurense* Alef. jam foliis et sepalis obtusis discernenda. A praecedente (sicut a *L. pallescenti* Bge.) pedicellis fructiferis reclinatis longe diversum.

5. *L. baicalense* Juz. sp. n. (§ *Adenolinum*).

Perenne; radice obliqua vel verticali debili vel plus minusve robusta lignescente pallida inferne plus minusve ramosa; caudex 1-multiceps; caules floriferi 1—12 in numero, erecti vel saepius basi paullo ascendentes, stricti vel in parte inferiore arcuato-curvati, tenuiusculi vel sat robusti, firmi, teretes, in planta sicca leviter sulcati, glaucescenti pallide virides, modice foliati, in $\frac{1}{2}$ — $\frac{1}{4}$ superiore ramosi ramis floriferis haud numerosis erecto patentibus, ramis sterili-

716 *bus deficientibus* vel *perpaucis brevissimis*; foliis 0.4—2.5 cm lg., 0.3—2.5 mm lt., infimis crebre dispositis parvis squamiformibus ovatis pallidis, caeteris linearibus vel lanceolatis erecto-patentibus acutiusculis vel acutis 1-nerviis, margine haud raro paullo revolutis glauco-viridibus; caules steriles (ad basin plantae) haud numerosi, breves et debiles. Inflorescentia haud vel sat multiflora e floribus 6—30 composita, ramulis foliis breviusculis anguste-lanceolatis vel oblongis bene foliatis; flores mediocres vel parvi plerumque non ultra 2 cm in diametro; pedicelli calyce 2—4-plo longiores crassiusculi, fructiferi elongati ad 1.5—2.5 cm lg., saepius parum curvati et laeviter attamen sat conspicue declinati; sepala 2.5—4 mm lg. et 1.5—2 mm lt. ovata acuta, interiora late ovata obtusiuscula breve mucronata, omnia inferne nervis 5 prominentibus percursa nigrescenti obscure viridia glaucescentia, margine anguste albomembranaceo-marginata; petala 8—14 mm lg., 5—9 mm lt., calyce 2—3-plo longiora, rotundato-obovata, obscure coerulea basi in unguem brevem flavescen-tem attenuata; stamina ca. 5 mm lg. (supra basin floris), antheris 1.3 mm lg., styli staminibus aequantes vel ad longitudinem antherarum breviores, fere usque ad basin liberi; stigmata parva. Capsula 5—7 mm lg., 4—6 mm in diam., calyce ca. duplo longior, late ovoidea ad subglobosa, flavida vel brun-nescens haud raro striis longitudinalibus percursa in sulcis inter valvulas dispositis vel ex toto obscure brunnea; semina ca. 4 mm lg. et 2 mm lt. brunnea. Floret VI—VII.

Habitat: in pratis siccis, in steppis et in declivibus lapidosis lit. occident. lac. Bajcal, Transbaicaliae, necnon Mongoliae borealis.

Typus speciei e Transbaicalia, Nertschinsk (leg. Karo) in Herbario Instituti Botanici Acad. Sc. URSS asservatur.

Affinitas: proximum *L. amurensi* Alef. et cum eo a cl. auctore con-fusum; illud tamen differt caulibus magis ramosis ramis sterilibus plerumque praesentibus, longis dense foliatis foliis latioribus planis laete viridibus, floribus minus numerosis majoribus, pedicellis tenuioribus fructiferis magis elongatis et declinatis vel nutantibus, sepalis ad 5 mm lg. acutioribus laete viridibus, capsula globosa straminea.

6. *L. subbiflorum* Juz. sp. n. (§ *Adenolinum*).

Planta perennis multicaulis caespites formans; radix adhuc ignota; cau-les humiles 7.5—11 cm alt., erecti, paullo curvati, tenues, basi lignescentes pallidi vel brunnescentes foliis squamiformibus tecti, caeterum pallide virides haud dense foliati; folia 4—12 mm lg., 0.7—1.5 mm lt. erecto-patentia lan-ceolata 1-nervia margine paullo involuta, acutiuscula vel acuta, glauco-viri-dia. Inflorescentia 2(4)-flora; flores relative ampli, 2.5—3 cm in diametro; pedicelli calyce $1\frac{1}{2}$ —2-plo longiores, tempore floreendi 6—10 mm lg., paullo curvati; sepala ca. 5 mm lg. et 2.5 mm lt., oblongo-ovata, acuta vel acutius-cula, sat anguste vel in sepalis interioribus latiuscule albo membranaceo-marginata, in parte inferiore nervis 3—5 prominentibus praedita, glauces-centi obscure viridia; petala 13—17 mm lg., 8—12 mm lt., calyce $3\frac{1}{2}$ longiora

717 obovata, in unguem sensim attenuata, margine sese conspicue tegentia ut videtur violascenti coerulea; stamina in forma longistyla (ut quoque styli in forma brevistyla) ca. 8 mm lg., in forma mesostyla ca. 6 mm lg. (quam styli breviora), in forma brevistyla (ut quoque styli in forma longistyla) ca. 4 mm lg.; antherae ca. 1.5 mm lg.; styli tenuiter filiformes stigmatibus parvis capitellatis. Fructus desiderantur. Floret Julio.

Habitat: in pratis alpinis Transcaucasiae australis (RASS Nakhitschevan, jugum Zangezur).

Typus e monte Dashurry-dagh in Herb. Horti Bot. Ac. Sc. URSS asservatur.

Affinitas: a *L. alpino* L. cui probabiliter proximum jam habitu peculiari et petalis sese lateraliter tegentibus diversa; caeterum est species parum nota ulterius observanda.

7. *L. altaicum* Ldb. in sched. olim (spec. restituenda) (§ *Adenolinum*).

Perenne, glabrum, caulibus paucis vel pluribus vel numero is, interdum subcaespitosus. Radix obliqua vel verticalis brevis sed robusta ramosissima lignescens albescens. Caules steriles plerumque adsunt bene evoluti quam caules fertiles fere non densius foliati; caules floriferi 2—15 in numero, 15—60 cm alt. basi plerumque paullo arcuato ascendentes, stricti vel curvati sat crassi et robusti, teretes, sicci sulcati, in triente superiore vel apice tantum ramosi ramis suberectis vel erecto patentibus infimis saepissime sterilibus sat elongatis, inferne foliis parvis oblongis obtusiusculis caule subappressis sat dense subimbricatis dein caducis tecti, postea cicatricibus sat dense dispositis, notatis caeterum foliis 0.5—3 cm lg., 1—5 mm lt. laete viridibus patentibus vel plerumque erectopatentibus parte inferiore saepissime caule adpressis sat densis vel superne sparsiusculis lineari-lanceolatis vel lanceolatis saepe asymmetricis in dimidio inferiore latoribus apice plerumque peracutis 1—5, (plerumque 3)-nervibus margine laevibus planis vel concavis vel in planta sicca saepissime margine convolutis tecti. Inflorescentia depauperata e floribus (1) 3—10 constans, ramis oliganthiis ad 5-floris; foliis ramealibus haud numerosis late lanceolatis longe acuminatis. Flores plerumque axillares initio approximati dein sat remoti ampli 3—3.5 cm diam. heterodistyli. Pedicelli 0.5—1.5 cm lg., fructiferi ad 2 cm lg. suberecti stricti vixve curvati sat tenues vel crassiusculi. Sepala 4.5—7 mm lg. 1.5—3.5 mm lt., exteriora ovato-lanceolata vel ovata acuta margine anguste albo-membranacea, interiora elliptica latiuscule vel late albo-membranacea apice obtusiuscula vel fere rotundata et mucronulata, laete vel sat obscure viridia. Petala 1.4—2.2 cm lg., 7—10 mm lt. sepalis subquadruplo longiora obovata, duplo longiora quam lata, apice rotundata vel subtruncata, basi in unguem sensim attenuata violascenti-coerulea basi pallescentia ungue lutescenti, sese lateraliter parum tegentia. Stamina in floribus brevistylis 7—8 mm lg., e calyce parum exserta, in longistylis—5—6 mm lg. (supra basin floris), e calyce (fere) non exserta, antheris ca. 1.5 mm lg. Styli 7—7.5 mm resp. 4.5—6 mm lg. filiformes

718 stigmatibus capitellatis. Capsula 7—8 mm lg., 5—6 mm lt. calycem sesqui—
ad duplo superans, ovoidea, apicem versus angustata substraminea vel super-
ne brunnescens. Semina ca. 4.5 mm lg., ca. 2 mm lt. oblique ovata comp-
ressa obscure brunnea paullo nitentia. Floret $\frac{1}{2}$ VI— $\frac{1}{2}$ VII.

Habitat: in pratis silvaticis, subalpinis et alpinis mont. Altai, Tarba-
gatai, Alatau Songorici et Tjan-Schan.

Typus speciei e mont. altaicis in Herb. Inst. Bot. Ac. Sc. URSS
asservatur.

Affinitas: foliorum caulinorum indole necnon caulibus robustioribus,
floribus submajoribus, petalis latioribus, calyce majore, staminibus (imprimis
florum brevistylorum) brevioribus ab affini *L. extraaxillari* Kit. diversa.

8. *L. borealis* Juz. sp. n. (§ *Adenolinum*).

Perenne, subcaespitosum, radicibus plerumque verticalibus sat robustis
flexuosis ramosissimis lignescens pallidis. Caules floriferi 2—6 in numero
plerumque humiles 10—30 (35) cm alt. erecti plerumque stricti sat tenues
rigidi teretes, in planta sicca sat conspicue sulcati, pallide virides plerumque
simplices vel rarissime bifurcati, 1-vel pauciflori, inferne foliis parvis squami-
formibus ellipticis vel subspathulatis pallidis diu persistentibus dense vel densis-
sime tecti, in folia normalia sensim transeuntibus; haec ultima 0.4—1.5 (2) cm lg.,
0.5—3 mm lt. sat crebre disposita erecto patentia vel patentia linearia vel oblance-
olata in medio vel saepissime paullo supra medium latissima uninervia vel inferne
subtrinervia basi angustata inferiora apice obtusa vel obtusiuscula caetera acuti-
uscula vel acuta margine laevia in planta sicca saepius convoluta flavescenti vel
sat laete viridia. Inflorescentia ad 5-flora; floribus initio approximatis post anthe-
sin remotis mediocribus vel sat amplis, heterodistylis; pedicelli 0.7—1.5 cm lg.
fructiferi ad 2 cm lg. strictissimi sat tenues. Sepala aequilonga 4—6 mm lg., 2—
3 mm lt. ovata vel anguste-ovata obscure viridia vel saepe atro-viridia inferne
prominule 3—5-nervia, 3 exteriora acuta haud marginata vel angustissime albo
marginata, 2 interiora obtusa anguste albo-marginata. Petala 1—1.8 cm lg.,
6—10 mm lt., sepalis subquadruplo longiora late-obovata apice rotundata
ut videtur violascenti-coerulea basi in unguem cuneiformem ut videtur albes-
centem vel flavescentem attenuata. Stamina in floribus longistylis 4—5 mm
lg., in brevistylis 6—8 mm lg. (supra basin floris), antheris 1.5—2 mm lg.
Styli resp. ad 6—8 mm vel ad 4—5 mm lg. filiformes stigmatibus capitel-
latis. Capsula ca. 6—8 mm lg., 5—6.5 mm lt. ovoidea apicem versus angus-
tata brunnescens. Semina ca. 4 mm lg., ca. 2 mm lt., ovata compressa,
matura obscure brunnea vix nitescentia.

Habitat: in rupibus necnon ad ripas fluviorum in montibus boreali-
uralensibus territoriisque adjacentibus.

Typus e reg. alpina m. Konzhakovski-kamenj a K. Igoshina lectum
in Inst. Bot. Ac. Sc. URSS asservatur.

Affinitas: cum speciebus affinis (praecedente et subsequente)
comparata differt statura humili, foliorum crebre dispositorum obtusiorum

719 saepius glaucescentium forma, sepalis obtusioribus atroviridibus, floribus minoribus brevius pedicellatis, capsulis brunnescentibus.

9. *L. Komarovii* Juz. sp. n. (§ *Adenolinum*).

Perenne, glabrum; radix obliqua vel verticalis, plerumque robusta, ramosa, lignescens, pallida; caules floriferi plures vel sat numerosi, 20—60 cm alti, erecti vel basi paullo curvati, stricti vel rarius subflexuosi, tenuiusculi vel sat robusti teretes, sicci paullo sulcati, in $\frac{1}{3}$ — $\frac{1}{4}$ superiore ramosi ramis medio-cribus vel sat longis patentibus inferioribus plerumque breviusculis saepe sterilibus; praeter caules floriferos etiam steriles breviusculi adsunt foliis minoribus densius dispositis; caules floriferi in parte inferiore foliis parvis ovato-lanceolatis vel lanceolatis paullo patentibus obtusiusculis vel acutis pallidibus sat dense dispositis caducissimis tecti; caetera laete viridia \pm patentia haud dense disposita majuscula lanceolata vel lineari-lanceolata basi plerumque angustata in media parte latissima apice acuta vel peracuta plerumque 3 (5)-nervia; margine laevia, plana vel (in pl. sicca) vix involuta. Inflorescentia haud multiflora; flores ampli, ca. 4 (ad 5) cm diam.; pedicelli plerumque 1.3—2 cm lg., sat tenues, fructiferi strictissimi ad 3 cm lg.; sepala 5—7.5 mm lg., plerumque ovata, acuta vel acutata, sat laete vel obscure viridia; petala ampla et lata, ad 1.5 cm lt., sepalis subquadruplo longiora, late obovata, apice rotundata, coerulea, basi pallescentia et in unguem flavescentem angustata; stamina florum longistylorum ca. 5—6 mm lg., florum brevistylorum ca. 8—10 mm lg., antheris ca. 1.5 mm lg., styli resp. ca. 8—10 et 5—6 mm lg.; capsula ampla, ca. 8 mm lg., ovata, straminea; semina 4.5 mm lg., brunnea nitescentia. VI—VII.

Habitat: in pratis ad ripas fluminum Sibiriae orientalis.

Typus e Jacutia (distr. Jakutsk, Namskij-ulus) in Herb. Inst. Bot. Ac. Sc. asservatur.

Affinitas: differt a *L. extraaxillari* Kit. foliis latioribus peracutis, floribus maioribus coeruleis, a *L. altaico* Ldb. — foliis patentibus, staminibus longioribus, pedicellis fructiferis tenuioribus, capsulis pallidioribus.

10. *L. atricalyx* Juz. sp. n. (§ *Adenolinum*).

L. altaico Ldb. affinis sed plerumque humilior, caule non ultra 40 cm lg., ramis sterilibus nullis vel valde abbreviatis. Folia glaucescenti-vel glaucoviridia, inferiora obtusiuscula vel obtusa vel haud raro apice rotundata. Flores iis *L. altaici* subminores 2.5—3 cm in diam.; sepala atroviridia; petala 1.5—2 cm lg., 1—1.3 cm lt. sesqui vel paullo ultra longiora quam lata margine sese tegentia obscure coerulea. Capsula ca. 6—7 mm lg. sepalis fere omnino occulta vel sesqui ea superans. Reliqua *L. altaici*.

Habitat: in pratis subalpinis et alpinis montium Alai necnon Tian-Schan occidentalis.

Typus speciei in valle Alai anno 1930 a S. Juzepczuk lectus in Herb. Inst. Bot. Acad. Sc. URSS asservatur.

Affinitas: cfr. supra in diagnosi.

11. *L. turcomanicum* Juz. sp. n. (§ *Adenolinum*).

Planta perennis habitu *L. altaico* Ldb. haud dissimilis; radix verticalis lignescens; caules 20—35 cm alt., sat numerosi, tenues, parum ramosi, foliis haud dense dispositis patentibus lineari-lanceolatis peracutis 3-nerviis glaucescentibus ad 2 cm lg. tecti. Flores ca. 3 cm diam.; pedicelli erecti infra calycem distinctissime nodulati; sepala ca. 5 mm lg. acuta vel tenuiter acuminata, obscure viridia margine albo-membranacea; stamina ca. 5 (in forma longistyla) vel ca. 8 (in forma brevistyla) mm lg.; stylus resp. ca. 8 vel 5 mm lg. Capsula ignota. Floret Junio.

Habitat: in Turcomania.

Typus speciei e Massinev a cl. Androssov lectus in Inst. Bot. Ac. Sc. URSS asservatur.

Affinitas: species non satis nota ex affinitate *L. altaici* Ldb. nonnullis notis (et praesertim foliis brevioribus et angustioribus glaucescentibus, floribus minoribus) *L. perenni* L. appropinquata, a quo tamen calycis indole etc. satis diversa. Etiam cum *L. sterili* Stapf (mihi ex authopsia ignoto) comparanda.

12. *L. brevisepalum* Juz. sp. n. (§ *Adenolinum*).

Perenne; radice verticali saepius debili haud raro valde flexuosa ramosa pallida. Caules 15—60 cm alt. plerumque haud numerosi, saepius erecti strictissimi, firmi, plerumque solum in parte $\frac{1}{4}$ — $\frac{1}{5}$ superiore ramosi ramis haud raro divaricatis; caules steriles sat raro observantur, plerumque debiles et breves; folia brevina vel breviuscula 0.5—2.5 cm lg., erecto-patentia vel plerumque etiam suberecta, glaucescenti vel glauco-viridia, obtusiuscula vel superiora (sat) acuta, 1—3-nervia. Flores saepius parum numerosa, 2—3 cm diam., breviuscule pedicellati pedicellis fructiferis plerumque non ultra 2 cm lg.; sepala breviuscula 3—4 mm lg., late ovata v. fere orbiculata, exteriora obtusiuscula vel obtusa, interiora apice rotundata, omnia breviter mucronata margine late albo membranacea; petala 1.3—1.8 cm lg., 0.7—1.3 cm lt., late obovata apice obtusata, coerulea unguibus flavescentibus; stamina in forma longistyli et styli in forma brevistyli 5—6.5 mm supra basin florum, longitudinem sepalorum notabiliter superantes; stamina in forma brevistyli et styli in forma longistyli ca. 8 mm lg.; antherae ca. 1.5 mm lg., breve ovoideae. Capsula 3—6 mm lg., 4—5 mm diam., late ovoidea vel depresso-globosa, plerumque calycem plus quam duplo superans, matura saepius brunnea; semina 3.5—4 mm lg. elliptica fere atro-brunnea, nitida. Caeterum *L. perenni* L. simile. Floret VI—VII.

Habitat: in steppis, in decliviis stepposi, in pratulis siccis et in lapidosis ap ripas fluminum Sibiriae orientalis.

Typus speciei e reg. Jenisseiensi (lac. Schiro) in Herb. Inst. Bot. Ac. Sc. URSS asservatur.

Affinitas: ab affini *L. perenni* L. (vero) imprimis foliis brevioribus erecto patentibus et sepalis brevibus perobtusis capsulae dimidium non attingentibus discernenda.

721 13. **L. euxinum** Juz. sp. n. (§ *Adnolinum*). — *L. squamulosum* auct. fl. Taur. p.p. non Rud.

Perenne; radix verticalis, tortuosa, debilis vel robusta, lignescens. Caules floriferi pauci vel numerosi (1) 2—18 in numero, 12—36 cm lg., basi modice curvati caeterum strictissimi sat graciles sed rigidi teretes siccatione leviter sulcati inferne violascentes vel brunnescentes, caeterum pallide virescentes, inferne (sicut caules steriles) creberrime foliati, postea cicatricibus foliorum delapsorum creberrimis notati, caeterum crebre foliati, apice corymboso pauciramosi. Folia 0.3—1.2 cm lg., 0.1—1 mm lt. erecta et caule subappressa vel erecto patentia, anguste linearia vel fere setacea uninervia, margine saepius involuta apice acutiuscula vel acuta glauco-viridia. Inflorescentia pauci vel sat multiflora floribus approximatis post anthesin parum remotis. Flores haud magni ca. 2 cm diam. heterostyli. Pedicelli calyce 1.5—2-plo longiores filiformes, fructiferi breviusculi infimi ad 1 cm lg., erecti vel erecto patentes stricti vixve curvati. Sepala parva 2.5—4 mm lg., 2—3 mm lt., 3 exteriora late ovata apice acutata vel obtusiuscula, 2 interiora fere rotundata obtusa vel mucronulata dorso nervis prominentibus 3 percursa glauco virescentia, margine eglandulosa, omnia (interiora latius) albo-membranaceo marginata. Petala ca. 12 mm lg. et 7 mm lt. sepalis 4—6-plo longiora late obovata basi in unguem cuneiformem flavescentem sensim attenuata apice rotundata, ut videtur coerulea. Stamina in speciminibus longistylis (sicut styli in speciminibus brevistylis) ca. 3 mm lg., in speciminibus brevistylis (sicut styli in speciminibus longistylis) ca. 6 mm lg. (supra basin floris); antherae ca. 1 mm lg.; styli filiformes stigmatibus capitellatis. Capsulae sat parvae ca. 4.5—6 mm lg.; 4—6 mm in diam., calycem 2—ad 3-plo superantes ovoideae apice subattenuatae acuminatae brunnescentes. Semina ca. 3.5 mm lg., ca. 2 mm lat. compresse ovata obscure brunnea nitida.

Habitat: in lapidosis et in declivibus apricis Tauriae (Sebastopol, Balaklava, penins. Tarchankut necnon Theodosia); caeterum in Caucaso occidentali (prope Novorossijsk) planta simillima crescit.

Typus e vicin. Sebastopolis a cl. acad. S. Korshinski lectus in Inst. Bot. Acad. Sc. USSR asservatur.

Affinitas: Planta a *L. austriaco* et *L. squamuloso* (vero) (pro quo vulgo habetur et quod est proles *L. austriaco* valde affinis) omnino diversa habitu, foliis angustissimis erectis vel suberectis, pedicellis fructiferis brevibus erectis, capsulis minoribus ovoideis.

Prope Sympheropolin et Karassu-basar planta *L. euxino* haud dissimilis a pluribus collectoribus lecta fuit ab eo tamen pedicellis fructiferis reclinatis recedens et melius cum *L. austriaco* collocanda; hanc in schedis nomine *L. Stevenianum* Juz. designavi.

14. **L. Marschallianum** Juz. sp. n. (§ *Adenolinum*). — *L. squamulosum* auct. fl. Taur. p.p. non Rud.

Perenne; radix saepe obliqua, plerumque crassa et robusta, lignescens. Caules floriferi numerosi, 8—30 (30) cm lg., basi decumbentes vel curvati, caeterum suberecti vel erecti, stricti vel interdum paullo flexuosi, crassiusculi, rigidi, teretes, inferne pallescentes, caeterum pallide virides sicut caules steriles dense et creberrime subimbricatum foliati foliis persistentibus, apice corymboso ramosi. Folia 2—10 (30) mm lg., 0.3—1 (2) mm lt. erecta vel suberecta linearia vel superiora lineari-lanceolata inferne dilatata uninervia margine plerumque involuta apice acuta vel peracuta laete viridia. Inflorescentia pauci- vel sat multiflora (ad 12-flora) floribus approximatis. Flores majusculi ca. 2.5 cm in diam. heterodistyli. Pedicelli calyce vix — ad duplo longiores crassiusculi, fructiferi sat elongati ad 2 cm lg. erecti stricti vel leviter curvati. Sepala sat magna 5—6 mm lg., 2.5—4.5 mm lt., 3 exteriora ovato elliptica apice acutata anguste albo-membranaceo marginata, 2 interiora late ovata vel obovata apice rotundata mucronata margine late albo membranacea nervis 3—5 percursa inferne valde prominentibus, glaucescenti-atroviridia. Petala ca. 1.5 cm lg., 1 cm lt., sepalis subtriplo longiora late obovata basi in unguem flavescentem sensim attenuata apice rotundata coerulea. Stamina in speciminibus longistylis (sicut styli in speciminibus brevistylis) ca. 4.5 mm lg., in speciminibus longistylis ca. 7 mm lg. (supra basin floris); antherae ca. 1.5 mm lg.; styli filiformes stigmatibus capitellatis breve ellipsoideis. Capsulae magnae ca. 8 mm lg. 6 mm in diam. calycem parum vel $1\frac{1}{2}$ (interdum duplo) superantes ovoideae apice acuminatae brunnescentes. Semina ca. 4.5 mm lg., ca. 2.5 mm lt., compressa oblique ovato-elliptica brunnea nitescentia.

Habitat: in declivibus petraeis montium Tauriae (jugum Jaila), m. Ai-Petri, jaila Babugan et supra pag. Gursuf.

Typus e declivibus lapidosis m. Roman-Kosh in Instituto Botanico Ac. Sc. URSS asservatur.

Affinitas: proximum *L. euxino* a quo satis diversum habitu, calyce majore atroviridi, capsula quoque majore attamen calycem plerumque solum sesqui (nec 2—3-plo) superante.

15. *L. uralense* Juz. nov. spec. (§ *Limoniopsis*).

Perenne, suffruticosum, caulibus sterilibus foliis rosulatum congestis spathulatis glaucis coronatis, plerumque paullo latoribus et brevius petiolatis quam in *L. ucranico* Czern.; folia caulina quoque latoria quam in *L. ucranico*, 1- vel saepe obsolete 3-nervia. Inflorescentia saepius haud multiflora, initio conferta, dein ramulis elongatis attamen iis *L. ucranici* brevioribus et crassiusculis; flores iis *L. ucranici* submajores; sepalia plerumque nigrescenti-viridia, latiuscula, ovato-lanceolata vel ovata; petala quam in *L. ucranico* latoria et firmiora. Capsula apice breve apiculata. Caeterum *L. ucranico* Czern. simillima. Floret Junio.

Habitat: in declivibus et calcareis lapidosis austrouralensibus.

Typus speciei e Bashkiria in Inst. Bot. Ac. Sc. asservatur.

Affinitas: vide supra.

Perenne, caulibus 5—40 cm alt. solitariis vel pluribus, erectis vel plerumque basi paullo arcuato-ascendentibus, tota longitudine dense et breviuscule lanuginoso-pilosis, in parte inferiore dense foliatis vel cicatricibus foliorum delapsorum dense dispositarum notatis; folia sessilia basin versus attenuata, inferiora sat anguste obovata vel spathulata, apice rotundata, superiora oblonga, apice obtusa vel acutiuscula; omnia plerumque 3-nervia, griseo-viridia utrinque dense patulo pilosa, suprema margine glandulis stipitatis haud numerosis praedita. Inflorescentiae axis sicut pedicelli brevissimi densissime patulo pilosa; sepala lanceolata longe acuminata extus, superne autem etiam intus, modo axis inflorescentiae pedicellorumque pilosa (pilis longioribus et magis patentibus quam in *L. hirsuto*), ni parte superiore margine sat crebre glanduloso-pilosa. Reliqua *L. hirsuti* L. Floret V—VII; fr. VI—VIII.

Habitat: In declivibus lapidosis (calcareis), in schistosis, in rupibus, in stepposis et in collibus apricis Tauriae sicut Transcaesiae occidentalis (regio opp. Novorossijsk).

Typus e vicin. opp. Sympheropol in Inst. Bot. Ac. Sc. URSS asservatur.

Affinitas: affinis *L. hirsuto* L., a quo praesertim pubescentia totae plantae et foliorum forma bene dignoscitur; attamen notandum est formam *L. hirsuti* in cretaceis Rossiae meridionalis crescere foliis caulinis quoque plerumque angustioribus saepissime 3-nerviis obtusioribus (imprimis superioribus) gaudentem quae tamen forma (caeterum ulterius examinanda) a nobis in schedis nomine *L. cretaceum* Juz. salutata quam *L. lanuginosum* et etiam *L. hirsutum* verum multo minus dense pilosa est et saepe folia fere glabra ostendit.

ZYGOPHYLLUM L.

17. *Z. oxianum* Boriss. sp. n.

Perenne; radix crassa, verticalis, lignosa; caules 30—50 cm longi, erecti, pauci, 1—3(5), herbacei, plerumque in parte superiore ramosi, dense striati, ramis plus minus adpressis, vix curvatis, internodiis 5—6 cm longis. Stipulae herbaceae, magnae (4) 5—7 mm longae, ovatae, obtusae. Folia bifoliolata, petiolis foliolo brevioribus, apice breviter mucronata, mucrone filiformi, molli; foliola foliorum inferiorum magna, oblique ovata vel rotundata, 2.5—4 cm longa, 1.5—3.5 cm lata, obtusa, plerumque remota; foliola foliorum superiorum minora. Pedicelli 10—12 mm longi. Flores et fructus in parte superiore dispositi, plerumque gemini vel solitarii, omnes erecti; sepala inaequalia, 3 elliptica, ad 8 mm longa, 4—5 mm lata, late membranaceo marginata, caetera (2) 6 mm longa, 4 mm lata, ovata, anguste membranaceo-marginata. Petala alba, in parte inferiore usque ad medium aurantiaca, ca. 10 mm longa, 3 mm lata, oblonga, apice rotundata; stamina 10, aurantiaca, 10—12 mm longa, antheris magnis, oblongis; squamulae filamentorum ca. 4 mm longae, oblongo-

724 lanceolatae, margine apiceque fimbriatae, papilloso scabrae; germen ovatum, stylus erectus, filiformis, germine 1.5-plo longior; receptaculum obliquum. Capsulae valde numerosae, breviter cylindricae, basi vix angustatae, 1.5—2(2.5) cm longae, 5—7 mm latae, 5-loculares, pentagonae. Semina numerosa, ca. 2.5 mm longa, ca. 2 mm lata, rotundato-ovata, grisea, laevia.

Habitat: deserta meridionalia, in argillosis, salsuginosis ad margines arenarum.

Typus: Turcomania, st. Jolatan ad fl. Murgab. 27 VI 1901, leg. N. Sorokin, fr.; in Leningrad asservatur.

Proximo *Z. Fabago* s. str. differt capsularum forma et dispositione et foliorum forma. *Z. Fabago* s. str. est species occidentalis, capsulis nutantibus anguste cylindraceis distincta.

18. *Z. macropodium* Boriss. sp. n. — *Z. Fabago* auct. non L. — *Z. obliquum* M. Pop. p.p.

Perenne; radix crassa, lignosa; caules 1—5, (40) 50—80 cm alti, erecti, herbacei; dense et tenuiter striati, furcatim parce ramosi, ramis divaricatis, internodiis longis. Stipulae parvae, acutae, herbaceae. Folia unijuga, apice breviter mucronulata; petioli anguste alati, foliis duplo breviores. Foliola majuscula crassiuscula, oblonga vel rotundato-ovata, apice rotundata, 3—4 cm longa, 1.5—3 cm lata. Flores breviter (5—10 mm) pedicellati, gemini, plus minus aequaliter per totam plantam dispositi; sepala 5, de quibus 3 late-ovata, ca. 8 mm longa, 5 mm lata, late albo membranaceo-marginata, cetera viridia 8 mm longa, 3 mm lata, ovata; petala 5, alata, 10 mm longa, 5 mm lata, de quibus 3 apice emarginata, oblonga, basi cuneato-attenuata. Stamina 10, ex eis 5, 12 mm longa; alia 14 mm longa; antheris ellipticis; squamulae filamentorum filamentis duplo brevioribus vel paulo longioribus lineatae, apice fimbriatae. Ovarium oblongum, styli erecti, filiformes, ovario duplo longiores; receptaculum obliquum. Capsula erecta, cylindrica, pentagono-prismatica, aptera, (2.5) 3—3.8 cm longa, 7 mm lata, utrinque obtusa, immatura linearis, stylo persistente brevi, curvato. Semina numerosa, ca. 10 in uno loculo, ovata, ca. 3 mm longa, 2 mm lata, nitentia, grisea, verruculosa.

Habitat in locis argillosis, in desertis salsis.

Typus: Kazachstania, inter fl. Ili et p. Borochudsir, 22 VII 1910, fr. n° 2319, lég. A. Michelson; in Leningrad conservatur.

Affinitas: a proximo *Z. obliquo* M. Pop. differt capsula et foliorum forma, staminibus exsertis, petalis longioribus, habitatione areaque.

19. *Z. microcarpum* Boriss sp. n.

Perenne; radix crassa, lignosa, multiceps; caules ca. 15 cm longi, striati, fragiles. Stipulae albo-membranaceae, triangulares, parvae integerrimae vel subcrenatae. Folia breviter petiolata (petiolis 3—4 mm longis), unijuga. Foliola asymmetrica, rotundato-ovata, obtusa, 6—12 mm longa, 5—8 mm lata. Flores solitarii vel gemini, pedicellis ca. 3 mm longis; sepala 5, oblonga,

725 ca. 7 mm longa, 3 mm lata; petala alba, parte inferiore usque $\frac{2}{3}$ aurantiaca, rotundata, unguibus brevibus cuneatis, apice subemarginata, ca. 6 mm longa, 4 mm lata; stamina miniata, exserta, ca. 10 mm longa; squamulae filamentorum 4 mm longae, lanceolatae, apice fimbriatae. Capsula 7—15 (20) mm longa, in parte inferiore 5—6 mm lata, ovato-oblonga vel lanceolato-oblonga, acuminata, valvulis umbellatim disruptis pentagona, subrecurva, capsula matura usque ad basin dehiscens valvis erecto patentibus, umbellatis. Semina 3—4 mm longa, ca. 1 mm lata, oblongo-lanceolata, basi acuminata, verruculis minutis griseis obsita.

Habitat: in gypsaceis desertorum borealium.

Typus: Kazachstan. Ad septentrionem ab oppido Balchasch, colles Kounrad, in gypsaceis 4 VII 1935. Leg. N. Rubtzov, fr.; in Leningrad conservatur.

Affinitas: *Z. latifolio* Schrenk et *Z. Rosovii* Bge. affine sed ab utroque foliorum, fructuum, stipularum et seminum forma et longitudine differt.

20. *Z. balchaschense* Boriss. sp. n.

Perenne; radix verticalis, crassa, multiceps; caules numerosi, a basi ramosi, erecti, 10—15 cm longi, glabri, striati. Stipulae concretae, herbaceae, virides, superiores anguste membranaceo-marginatae, nonnunquam crenatae, semirotundatae vel ovatae, ca. 2 mm longae et 3 mm latae. Folia 1.5—2.5 cm longa, petiolis alatis et incrassatis, apice mucrone subulati, molli vel saepe foliolis parvis. Foliola 3—4-juga, crassiuscula, oblonga, lanceolata vel linearia, acutiuscula vel obtusiuscula, 8—12 mm longa, 1.5—3 mm lata, basi acuminata, viridia. Pedicelli florioribus subaequilongi vel breviores. Flores axillares solitarii vel gemini, erecti sursum vergentes; receptaculum incrassatum; sepala 5 mm longa, 3 rotundata, tenuiter albo membranaceo-marginata, ca. 4 mm lata, cetera 2 ovata, viridia, ca. 3 mm lata; petala alba, 7 mm longa, ovata, obtusa. Stamina alba, 7 mm longa; squamulae filamentorum lineares, ca. 5 mm longae, apice fimbriatae, extus dense papillari scabrae. Ovarium glabrum, ovale. Capsula ovato-rotundata, pentagona, nonnunquam patula, 8—10 mm lata, 10—14 mm longa, obtusa, stylis filiformibus persistentibus. Semina numerosa, 3—3.5 mm longa, 1.5 mm lata, oblonga, apice acuminata, dense verruculis minutis setuliformibus obsita.

Typus: ad lac. Balchasch, VI—VIII 1843 fr., leg. A. Schrenk; in Leningrad conservatur.

Affinitas: a proximo *Z. subtrijugo* C.A.M. caulibus erectis (nec diffusis), foliorum forma, capsulis rotundato-ovalibus differt.

21. Sect. *Pterocarpum* Boriss. sect. n.

Capsula anguste vel late-alata, rotundata vel oblonga vel lanceolata, acuminata, apice angustata. Plantae Asiae Mediae orientalis et Asiae Centrali-occidentalis propriae.

Sectioni *Eufabago* M. Pop. affinis est sed capsulae forma (non cylindrica et aptera vel obsolete alata) et area geographica differt.

22. *Z. kopalense* Boriss. sp. n.

Perenne; radix crassa, multiceps, lignosa. Caules numerosi, 6—8 cm longi, tenues striati, ramosi. Stipulae parvae, ca. 1 mm longae, membranaceae, albae, triangulari-ovatae. Folia 2—3 cm longa, petiolis rachi subaequilongis, apice mucrone brevi viridi terminata; foliola (2) 3—4-juga, oblonga vel oblongo-elliptica, 5—8 mm longa, obtusa, 2—3 mm lata. Pedicelli floribus subaequilongi vel breviores. Sepala ca. 8 mm longa, ca. 2 mm lata; petala sepalis vix longiora, alba, 9—10 mm longa, ca. 3 mm lata. Stamina ca. 5 mm longa; squamulae filamentorum lanceolatae. Ovarium apice acutum, basi dilatatum, capsulae non maturae acuminatae pentagonae, erectae sursum vergentes.

Typus: Kazachstania in systemate fl. Kopa, in loco Dulon-kara in argillosis rubris salsis 5 V 1909 fl. fr. juven., leg. B. Vvedensky; in Leningrad conservatur.

Affinitas: proximum *Z. oxycarpo* M. Pop. sed foliolorum forma et numero differt.

23. *Z. cuspidatum* Boriss. sp. n. — *Z. mucronatum* M. Pop. p.p. non Maxim.

Perenne; radix crassa, multiceps, lignosa, brevis; caudex multiceps, planta pulvinata. Caules numerosi, herbacei, 5—6 cm alti, tenues, fragiles, tenuiter striati, glabri vel pilis raris obsiti, erecti vel tortuosi, subramosi, partibus vetustioribus lignosis persistentibus; stipulae membranaceae, albae, parvae, 0.5—1 cm longae, non connatae, triangulari-ovatae, crenatae et fimbriate-marginatae. Folia 1.5—2 cm longa, crassa, in articulatis strangulata, internodiis brevibus, apice subulato-mucronata. Foliola 2—4-juga, oblonga vel oblongo-lanceolata, acute mucronulata vel obtusiuscula, 4—8 mm longa, 1.5—2 mm lata, papillis obtusis cum petiolis tecta. Flores ignoti. Capsulae axillares, patulae, pedicellis 4 mm longis, 10—17 mm longae, in parte inferiore ca. 5 mm latae, apice acutae, 5-alatae, membranaceae. Semina ca. 3 mm longa, 1 mm lata, pallide-viridia, foveolata.

Typus: Asia media. Distr. Dsharkent. Inter Temerlik et Chuschanai. In semidesertis artemisiacis; 24 VI 1912; leg. Saposhnikov et Schischkin; in Leningrad conservatur.

Affinitas: Nostra species affinis est *Z. mucronato* Maxim., quocum interdum confusa, sed statura pulvinata, radice crassa multicipiti, stipulis membranaceis, capsulis quinquealatis (nec pentagonis), seminum forma et magnitudine statim dignoscitur.

24. *Z. karatavicum* Boriss. sp. n.

Perenne; radix crassa, verticalis; caudex multiceps brevis; caules numerosi, erecti, in parte superiore subramosi vel simplices, 1.5—2 mm in diam., 8—14 cm alti, tenuiter striati; stipulae triangulari-ovatae, albo membranaceo-

727 marginatae et fimbriato-crenatae, vel herbaceae 1—1.5 mm longae. Folia superiora 2—3 cm longa, apice albo filiforme mucronata; folia inferiora 3—4 cm longa; foliola (2) 3—4-juga, distantia, spathulata, basi cuneato-acuminata, apice obtusa, 5—10 mm longa, in parte superiore 2—3 mm lata. Flores breviter (5—6 mm) pedicellati, in fructificatione patuli, solitarii vel gemini in axillis dispositi; sepala 3 ovata, acutiuscula, 7 mm longa, ca. 4 mm lata, duo oblonga 6 mm longa, in parte superiore 3 mm lata, obtusa, basi subacuminata; petala 3 mm longa, lamellis 2.5—3 mm latis, unguibus tenuibus, apice obtusiuscula. Stamina ca. 3 mm longa, antheris ca. 1 mm longis; squamulae filamentorum elate connatae apice subimbricatae. Ovarium oblongo-ovatum, pentagonum. Capsula ovata, asymmetrica, pentaptera, apice vix acuminata obtusiuscula, 15—18 mm longa, in parte media ca. 8 mm lata. Semina (non matura) oblonga, apice acuminata basi obtusiuscula, laevia, brunnea, 2—5 in loculo.

Typus: in Jugo Tjan-schan. Montes Karatau in loco Ksyl-naisa in declivibus rubro-argillosis 14 VI 1931, n° 203; leg. N. V. Pavlov; in Leningrad conservatur.

Affinitas: *Z. oxycarpo* M. Pop. affine est, sed foliolorum jugis 3—4 (nec 2—3), foliolis 5—10 cm longis, 2—3 cm latis (nec 8—20 mm longis et 1—2.5 cm latis), pedicellis longioribus, capsulis obtusiusculis, ovatis, 15—18 cm longis, ca. 8 mm latis (nec lanceolatis 20—30 mm longis, 7—10 mm latis) sat diversum est.

25. *Z. taldy-kurganicum* Boriss. sp. n.

Planta glabra, radix crassa, lignosa, ramis numerosis funaliformibus; caules numerosi, basi lignescentes, tortuosi, ramosi, striati, ca. 15 cm alti. Stipulae membranaceae, inferiores — ovatae, superiores lanceolatae, acuminatae, ca. 2 mm longae. Folia 1.5—2 cm longa, apice vix albo-mucronulata, petiolis axi aequilongis vel sublongioribus; foliola crassiuscula, plana, glabra, late-ovata, 8—12 mm longa, 5—9 mm lata, obtusa, asymmetrica. Flores ignoti. Capsula breviter pedicellata, pedicellis 2—4 mm longis, oblonga, 2.5—3 cm longa, 10—14 mm lata, membranacea, alae loculo aequilongae. Semina ovata, magna, ca. 6 mm longa, 3 mm lata, uno latere obtusa et altero latere acutiuscula verruculis numerosis griseis obsita.

Typus: Kazachstania, distr. Taldy-kurgan inter lacum Uch-kul et fl. Karatal. In argillosis rubris gypsaceis ad pedem montis, 17 VII 1928 n° 930, fr. leg. N. Schipczinsky; in Leningrad conservatur.

Affinitas: *Z. pterocarpo* Bge. affine est, sed foliolorum, capsularum et seminum forma differt.

26. *Z. kegense* Boriss. sp. n.

Radix longa, lignosa, multiceps, ramosa. Planta dense caespitosa; caules herbacei vulgo erecti, 5—10 (15) cm alti, verrucis raris obtusis, brevibus

728 obsiti. Stipulae divisae, membranaceae, albae, triangulari-lanceolatae fimbriato-marginatae. Folia 2—3 cm longa, crassa, glabra, lamina petiolis triplo longior; axis foliorum in loco foliolorum insertionis strangulatus; foliola crassiuscula, lanceolata vel lanceolate-oblonga, 7—12 mm longa, 1.5—2 mm lata, obtusiuscula, 2—3(4)-juga. Flores solitarii vel gemini, axillares, ca. 10 mm longi, pedicelli 5—10 cm longi, erecti; sepala magna, 8 mm longa, 3—5 mm lata, elliptica, obtusa; petala 10—11 mm longa, in sicco flavescentia, basi cuneata, apice obtusa, 3—5 mm longa; stamina petalis vix longiora; squamulae filamentis triplo breviores, lineares, marginibus non profunde crenatae. Ovarium pentagonum, stylis filiformibus, longis. Capsula quinquealata, ovato-elliptica (1) 2—3 cm longa, (1) 1.3—1.8 cm lata, basi subattenuata, apice breviter mucronulata; alis tenuibus, membranaceis, 7—9 mm latis; semina numerosa, 3—5 in loculo, ca. 4 mm longa, ca. 1.5 mm lata, facie dense breviterque granulata, grisea.

Habitat in decliviis aridis, argillosis in Kazachstania et Kirghizia.

Typus: Kazachstania, distr. Kegen, in jugo Temerlik, 11 VII 1934, fr. leg. B. K. Schischkin; in Leningrad conservatur.

Affinitas: *Z. macroptero* C.A.M. affine est, sed capsularum et foliolorum forma differt.

27. Sect. **Xanthoxylon** Boriss. sect. n.

Flores tetrameri; capsulae ellipticae vel rotundatae, 3-alatae, 3-loculatae, apice non emarginatae. Plantae glabrae; folia 1—2-juga.

Nostra sectio affinis est sectioni *Atriplicoides* Borišs. sed capsulis 3-alatis (non 4-et 5-alatis), foliis compositis (non simplicibus) differt.

28. **Z. kaschgaricum** Boriss. sp. n.

Frutex ramis tortuosis, spinosis, internodiis brevibus, cortice albido-griseo, obsolete striato. Stipulae parvae, membranaceae. Folia bifoliolata, carnosa, petiolo 6—10(15) mm longo, in ramis novellis opposita, in ramis vetustioribus fasciculata; foliola carnosa, linearia, petiolo subaequilonga. 6—10(17) mm longa, obtusa. Flores axillares, solitarii vel gemini breviter pedicellati, pedicellis 6—10 mm longis; sepala saepe persistentia, in numero (3) 4, carnosa, elliptica. Receptaculum capitatum carnosum, concavum. Petala ignota. Capsula elliptica, ca. 23 mm longa, ca. 13 mm lata, basi attenuata, apice obtusiuscula vix emarginata membranacea, tenuissime reticulato-venosa. 3-alata; alis loculis 1.5—2-plo latioribus. Semina 1—2 in loculo, semioblonga, ca. 8 mm longa, 2.5 mm lata, luteola vesiculosa.

Typus: Kaschgaria, prope Kschui-ky (15 km), 8 VIII 1913, n° 1048, fr. leg. O. Knorring; in Leningrad conservatur.

Affinitas: a proximo *Z. xanthoxylo* (Bge.) Maxim. capsularum forma, dimensione ac colore, sepalis persistentibus, foliolorum forma differt.

729 29. Subgen. **Halimiphyllum** Boriss. subgen. n.

Frutex; folia simplicia, juniora pube furfuracea stellata vestita. Flores et fructus tetra- vel pentameri. Capsula magna, alata.

Caucasus australis; Turcomania in jugo Kopetdag, Iran, Pamiro-Alaj, Tjan-shan australis.

Subgenere *Sarcozygium* (Bge.) Boriss. affine est sed capsularum forma (non 3-alata) foliis et floribus differt.

Typus subgeneris: *Z. atriplicoides* Fisch.

30. **Z. Gontscharovii** Boriss. sp. n. — *Z. atriplicoides* auct. non Fisch. — *Z. atriplicoides* var. *tetramerum* M. Pop. p.p.

Frutex, 60—120 cm altus, cortice griseo, striato, ligno luteolo. Stipulae parvae, triangulares, latiores quam longae acutiusculae. Folia pallide-viridia, simplicia, 2—2.5 cm longa, 10—15 mm lata, juniora albo-tomentosa dense pube furfuracea steliata vestita, demum subglabra, integerrima, crassiuscula, laminis rotundatis vel ovatis, apice obtusa, nonnunquam vix emarginata, breve petiolata, petiolis 3—7 (10) mm longis. Pedicelli pubescentes 5—10 mm longi. Flores axillares solitarii, praecipue nutantes; sepala 4 viridia, pilis stellatis vestita, duo obovata, ca. 6 mm longa, 4—5 mm lata, albo late-marginata, apice emarginata, basi attenuata, altera — ovata, 4 mm longa, ca. 3 mm lata, basi dilatata, apice obtusa, albo et anguste-marginata; petala 4, in sicco subluteo-alba, 8—10 mm longa, duo eorum in parte superiore 6—7 mm lata, basi cuneato attenuata, apice obtusa vel vix emarginata altera paulo angustiora. Stamina 8, exserta; squamulae filamentorum ca. 4 mm longae, oblongae, in parte superiore crenato marginatae. Ovarium oblongum, 4-loculare, breve stipitatum, stylus filiformis ovario triplo longior. Capsula tetramera, subrotundata, 2—2.5 cm lata, 2.3 cm longa, vix emarginata. Alae pallide-stramineae, membranaceae; semina praecipue solitaria, magna, 8—10 mm longa, (3)5 mm lata, semilunata, compressa, facie lucida, fusco-viridia, vesiculosa.

Habitat: in decliviis lapidosis, rubro-arenosis et gypsaceis, 420—1150 m, saepe inter Pistaceas.

Typus: In Tadshikistania orientali prope pagum Sangtuda, 30 V 1932, n° 109, fr. leg. N. Gontscharov, G. Grigorjev et V. Nikitin; in Leningrad conservatur.

Affinitas: a proximo *Z. euryptero* Boiss. forma et magnitudine capsularum, foliorum forma et V. area geographica differt.

31. **Z. darvasicum** Boriss. sp. n. — *Z. atriplicoides* auct. non Fisch.

Frutex, 60—120(?) cm altus, ramis virgatis subramosis, cortice albidogriseo, striato. Stipulae parvae, acutiusculae. Folia juniora pube furfuracea stellata vestita oblongo-elliptica, demum subglabrescentia pube praecipue in petiolis persistente; folia evoluta magna, rotundato-elliptica, obtusa et apice emarginata, 2.5—3.5 cm longa, petiolis alatis, laminis duplo brevioribus.

730 Pedicelli brevi, 3—5 mm longi, dense villosi, in fructificatione elongati ad 12—20 mm longi sursum vergentes pilis persistentibus tecti. Flores pentameri, axillares, solitarii vel gemini; sepala 5, inaequalia, dense villosa duo ca. 6 mm longa, ovata, late hyalina marginata, basi attenuata, cetera ca. 5 mm longa, rotundata anguste hyalino-marginata, obtusa, basi dilatata; petala alba, ca. 9 mm longa, apice obtusa, basi cuneata acuminata. Stamina 10, ex eorum 5, 14 mm longa, petalis vix longiora; squamulae filamentis triplo breviores. Ovarium ovatum 5-loculare. Capsulae juniores virides, rotundatae, quinquealatae, alis latis; semina ovato-elliptica, 7—9 mm longa, 4—5 mm lata, grisea, lucida, vesiculosa.

Typus: Tadshikistania. Darvaz, supra pagum Kala-i-humb inter Tokrai et Chergowat ad fl. Pändsch, in decliviis lapidosis; 1400—1700 m., III—IV 1883, fl., leg. Mussa; in Leningrad conservatur.

Affinitas: a proximo *Z. megacarpum* Boriss. ramis virgatis, pedicellis villosis in fructificatione elongatis et erectis, sepalorum petalorumque forma differt.

32. *Z. megacarpum* Boriss. sp. n. — *Z. atriplicoides* auct. non Fisch.

Frutex, 2—2.5 m altus, 2—3 cm in diametro, ramis crassiusculis, striatis, cortice griseo flavescente tectus; stipulae breves, latiores quam longae acutiusculae vel acuminatae deciduae. Folia simplicia, juniora albescentia, pube stellata dense vestita, demum glabrescentia viridia, integerrima, spathulata, elliptica, ovata vel rotundata, petiolum vel eam laminae dimidio aequilonga vel eam subaequantem attenuata. Folia juniora, in fructificatione 1.5—2 cm longa breve petiolata; folia evoluta 3—5 cm longa, 1—2.5 cm lata, apice obtusa, juniora opposita, ramis vetustioribus fasciculata. Flores axillares solitarii vel gemini pentameri, aurei, brevi, 3—5 mm longi, pedicellati; sepala 5, viridia, de quibus 3 subglabrae, late-ovata, ca. 6 mm longa, ca. 4 mm lata, luteola, membranaceo-marginata, apice emarginata, basi vix acuminata, cetera 2 depauperata pauce pube stellata vestita, elliptica, basi lata, apice acutiuscula, (2) 4 mm longa, 1.5 mm lata; petala aurea, convexa 10—11 mm longa, 6—7 mm lata, late-ovata, basi cuneato-acuminata, apice rotundata. Stamina 10, ex eorum 5 petalis aequilonga, alia 5 ca. 13 mm longa; antherae rotundatae; squamulae filamentorum ovatae, fimbriate-marginatae filamentis 4-plo breviora. Ovarium quinqueloculare, pentagonum ovatum, stylis filiformis longis, ca. 13 mm in fructificatione longe persistentibus. Receptaculum crassiusculum capitato-carnosum non obliquum. Capsula vulgo solitaria rare gemini, pedicellis carnosus, brevis 5—10 mm longis rite nutantibus, retusioribus persistentibus; capsula pentaptera, breve stipitata, 3—4.5 cm longa, 3.5—4 cm lata, viridia vel viridiuscula, in parte media subfusca, alis tenuis membranaceis, lucidis, loculo 3-plo, latioribus. Semina reniformia, semirotundata vel angulata, 1—3 in loculo, magna, (8) 10—12 mm longa, (4) 5 mm lata, juniora atrofusca, lucida, facies tuberculata, acuta.

731 **Typus:** Fergana, Distr. Dshelalabad in declivibus prope Suzak, 1100 alta; 26 VI 1945, n° 51, fr.; leg. A. Kalinina et Moreva; in Leningrad conservatur.

Affinitas: *Z. atriplicoides* Fisch. affinis est sed foliis magnis, capsulis magnis 3—4.5 cm latis, 3.5—4 cm longis (non 1.5—2.5 cm latis, 1.5—2 cm longis), floribus forma etc. differt.

33. Subgen. **Pseudococcus** Boriss. subgen. n.

Capsulae baccaeiformes, apterae, ellipticae. Subgenere *Fabago* M. Pop. affinis est sed capsularum forma differt.

Typus subgeneris: *Z. gobicum* Maxim.

HAPLOPHYLLUM RCHB.

34. **H. multicaule** Vved. sp. n.

Glauescens, multicaule, p. m. pubescens, suffruticulosum. Caudex cortice griseo vel flavescenti griseo, lignosus, crassus, ramosus, caules herbaeos, tenues, simplices vel pauce ramosos, eglandulosos, crebre foliosos edens. Folia sessilia, obtusa, basin versus sensim angustata, ob glandulas marginales subprominentes crenulata, faciebus glandulis punctiformibus, solitariis adspersa, infima obovata vel oblanceolata, media et superiora oblanceolata, vel sublinearia, suprema diminuta linearia. Inflorescentia laxiuscula, floribus breviter pedicellatis. Bractae lineares. Calyx persistens, sepalis triangulari-ovatis vel ovatis, acutiusculis vel obtusis, pubescentibus, ca. 1 mm longis. Petala videtur pallide lutea, dorso p. m. pubescentia, interdum viridipurpureo suffusa, oblonga vel oblongo elliptica, in unguem brevem (ca. 1 mm) subito contracta, 5—6.5 mm longa, 2—2.5 mm lata. Filamenta libera, eglandulosa, apicem versus p. m. sensim angustata, infra medium barbata, petalis sesqui breviora. Ovarium stipitatum, tuberculatum, pubescens, loculis subexappendiculatis. Stylus pilosus. Capsula dehiscens, tuberculata, villosula, loculis tuberculo majore apiculatis, 3—3.5 mm lata.

Affine *H. obtusifolio* Ldb. et praesertim *H. ramosissimo* m., sed capsulae loculis brevius appendiculatis facile dignoscitur.

Habitat: in gypsaceis, caementis, rarius arenosis in desertis Asiae Mediae septentrionalibus promontoriisque Tianschanicis adjacentibus a curso inferiore fl. Sary-su ad fl. Tschilik.

Typus: montes Tschu-Ili, Tschokpar, in artemisietis; leg. Abolin 12 VII 1926 n° 560 (in Herb. Hort. Bot. Univers. As. Med. sub n° 87823 conservatur; cotypus n° 87824).

35. **H. leptomerum** Lincz. et Vved. sp. n.

Suffrutescens, glabrum, pluricaule. Caules virgati, basi adscendentes, superne ramosi, luteo-viridi, glandulis punctiformibus adspersi, apice nudi, 25—50 cm alti. Folia carnosula, glaucescentia, in statu juniore glauca, glandulis punctiformibus, impressiusculis obsita, a basi 3-costa segmentis linea-

732 ribus basin versus sensim angustatis, canaliculatis; infima et summa indivisa, diminuta. Inflorescentiae ad apices caulibus ramorumque corymbiformes sat densae. Bractae paucae, lineares. Sepala persistentia, ovata, obtusa, glabra, ca. $\frac{3}{4}$ mm longa. Petala¹ flava, glabra, elliptica, obtusa, sat sensim in unguem brevem ($\frac{3}{4}$ —1 mm) angustata, 3.5—5 mm longa, 1.5—2 mm lata. Filamenta libera, glandulosa, intus sub medio barbata, triangulari-oblonga, p. m. sensim in filum breve angustata, petalis duplo breviora. Ovarium sessile, pubescens, minutissime tuberculatum, appendiculatum. Capsula dehiscens, pubescens, subsessilis, dense glanduloso punctata, appendicibus brevibus corniculiformibus ornata, 3—3.5 mm lata.

Affine *H. folioso* Vved. et praesertim *H. tenuisecto* n., ab utroque ovario capsulaque pubescentibus, appendicibus majoribus differt.

Habitat: in gypsaceis montium Pamiro-Alaj australis (Asia Media).

Typus in jugo Babatag, prope trajectum Korkutal, in schistosis. Alt. 1550 m s. m. 17 VII 1938 fl. et fr. Linczevski n° 417; in Leningrad asservatur.

36. *H. tenuisectum* Lincz. et Vved. sp. n.

Suffrutescens, glaberrimum, pluricaule. Caules virgati, basi interdum leviter adscendentes, superne ramosi vel rarius simplices, luteo-viridiglandulis punctiformibus interdum prominentibus dense tecti, apice subnudi, 40—85 cm alti. Folia carnosula, glaucescentia, in statu juniore glauca, glandulis punctiformibus impressiusculis obsita, a medio 3(6)-secta segmentis linearibus basin versus sensim angustatis, canaliculatis obtusis; infima et summa indivisa diminuta, illa spathulata, haec linearia. Inflorescentiae ad apices caulibus ramorumque corymbiformes sat densae. Bractae foliis summis similes sed valde diminutae. Sepala persistentia, ovata, obtusa, glabra, tuberculata, ca. $\frac{3}{4}$ mm longa. Petala flava, glabra, elliptica vel oblongo ovata, obtusa, abrupte, saepissime auriculato in unguem brevem (1)2—3(4) mm longum contracta, 5—6 mm longa, 2—3 mm lata. Filamenta libera, glandulosa, subaequalia, triangulari-oblonga, subito in filum breve angustata, medio intus barbata, petalis duplo breviora. Stylus brevis, glaber. Ovarium sessile, glabrum, sublaeve, appendicibus minutis tuberculiformibus. Capsula dehiscens, glabra, subsessilis, dense glanduloso punctata, appendicibus minutis tuberculiformibus instructa vel eis destituta 3—3.5 mm lata.

Affine *H. folioso* Vved. Boiss. et *H. leptomero* n. et quasi intermedium, foliis a medio sectis, pseudopetiolatis sat specificè differt. A *H. filifolio* Spach ovario sublaeve appendiculato longius distat.

Habitat: ad declivia gypsacea montium Pamiro-Alaj australis (Asia Media).

Typus: in desertis promontorii prope urbem Kabadan. 14 IX 1931 fl. et fr. leg. Gontscharov et Matveev. n° 276.

POLYGALA L.

37. *P. Kemulariae* Tamamsch. sp. n.

Basi suffruticosa, caules adscendentes, molliter pubescentes, folia inferiora obovata vel spathulata altera linearia vel lineari-lanceolata; racemi juveniles comosi, bracteae pedicellum aequantes vel superantes. Alae late-obovatae brevissime apiculatae corollam subaequantes, nervo medio ramoso, ramis anastomosantibus; tubus corollae quam pars libera petalorum brevior; ovarium obovatum, capsula obovata emarginata vix stipitata. Arilli appendices laterales trientem seminis superantes.

Typus: Transcaucasia, Georgia. Kutais. Leg. Kemularia; in Tphlisi conservatur.

Ad *P. nicaensem* Risso accedit, sed habitu minore, forma seminum appendicibus arilli brevioribus sat distincta.

38. *P. colchica* Tamamsch. sp. n.

Caules numerosi basi interdum lignescentes, 15—18(25) cm alti, subglabri, adscendentes; folia densa parva, angusta, infima lanceolata, superiora linearia, 1.5—2 cm lg.; internodia abbreviata; racemi terminales 5—7 cm longi, non densiflori; bracteae bracteolis longiores. Flores majusculae; alae lanceolatae, basi angustiores, apice subapiculatae ad marginem saepe pilosae, trinerviae, nervibus inter se pauce anastomosantibus; tubus corollae arcuato-curvatus, tenuis, alae valde superior. Ovarium fere duplo pedunculo brevius; capsula pedunculo aequilongo suffulta late marginata; semina oblonga, arilli appendices breves inter se subaequales.

Transcaucasia occidentalis.

Typus: Abchasia, in collibus graminosis circa Jurjevskoe (Tzebelda) O. Voronova (f. *rosea*); Ibidem G. Voronov (1907) (f. *alba*); in Leningrad conservatur.

Affinitas: omni habitu *P. anatolicae* Boiss. et Heldr. affinis, sed forma alae, corollae et ovarii valde differt. A *P. majore* Jacq. habitu graciliore, dimensionibus florum minoribus, tubo corollae valde arcuato diversa est

ANDRACHNE L.

39. *A. pusilla* Pojark. sp. n.

Planta suffruticosa, parva, ad 12 cm alta, rhizomate ramoso incrassato, ad 5 mm diam. indurato, brunnescente, caulibus hornotinis tenuibus, 0.3—0.5 mm diam., simplicibus, dense pilosis; stipulae peltatae, latae, marginibus laciniatae, apicem versus longe attenuatae, albae, demum fuscae, basi purpureo coloratae. Folia laeta, glauca, orbiculata vel late elliptica, apice obtusa, nonnumquam apiculata, basi late cuneata vel truncata, breviter petiolata vel subsessilia. Flores in axillis foliorum solitarii; florum masculorum pedicelli tenuissimi, 1.5—2.5 mm longi, sepala 1.75—2 mm longa, 0.6—0.7 mm lata, ovato-lanceolata, acuminata, petala ca. $\frac{1}{3}$ sepalis breviora 1.2—1.4 mm longa,

734 0.3—0.4 mm lata, angusta, ligulata, apice retusa disci glandulae bilobatae, lobis acutis, filamenta ad $\frac{1}{3}$ — $\frac{1}{4}$ in columnam connata; florum femineorum pedicelli 2.5—3 mm longi, sepala 2—2.5 mm longa, 0.7—0.9 mm lata, viridia, margine anguste albo marginata, elongate-ovata, acuta vel rotundata, apiculata; petala 0.5—0.75 mm longa, 0.2 mm lata, anguste lingulata, disci glandulis paulo longiora; glandulae bilobatae, lobis obtusis ovatis; capsula depresso globosa, glabra 1.75 mm longa, 2.25 mm lata. Semina parva, elongata, 1.25—1.5 mm longa, 0.4—0.7 mm lata.

Typus: Asia media, juco Gazimajlik (Pamiro-Alaj austro-occidentalis) pr. pag. Dagana. 91X1931. leg. N. Gontscharov et M. Matveev. n° 230; in Herb. Inst. Bot. Acad. Sc. URSS conservatur.

Habitu *A. pygmaeae* valde similis, a qua petiolis brevioribus vel nullis, floribus majioribus, florum masculorum sepalis angustioribus acuminatis (non obtusis), disci glandularum lobis acutis (non obtusis), florum femineorum petalis angustis.

FLÜGGEA WILLD.

40. *F. ussuriensis* Pojark. sp. n.

Frutex glaber, ramis juvenilibus ramulisque tenuibus, argutis, cortice viridi nigro punctati; stipulae parvae; folia 1.8—7 cm longa, 0.6—3.3 cm lata, obovata, apice acuta vel breviter mucronulata, basi cuneata, marginibus revolutis, nonnunquam minutissime undulatis, utrinque glabra, opaca, supra atroviridia, subtus pallidiora glaucescentia, subrugosa, nervo medio laterali-busque supra profunde insculpta, subtus valde prominentibus; petiolis 4—9 mm longis, laminis 6—9-plo brevioribus. Flores dioici in axillis foliorum 5—20 fasciculati, pedunculis glabris, 3—5(6) mm longis; florum masculorum sepala 5, concava late-obovata vel elliptica, obtusa, apice remote serrulata, petala nulla, disci glandulae 5, basi angustatae, alterni sepalae, stamina 5, raro 4, filamentis liberis, antheris late ellipticis sepalis 2—2.5-plo longiora; rudimentum ovarii ad medium vel ultra bilobum. Flores feminei et fructus ignoti.

Typus: in regione Austro-ussuriensi, prope pag. Kondratenkovo ad marginem silvae montanae VIII 1933, leg. V. Komarov; in Herb. Inst. Bot. Ac. Sc. URSS conservatur.

Affinitas: *A. F. leucopyrus* Willd. foliorum forma differt.

EUPHORBIA L.

41. *E. Komaroviana* Prokh. sp. n. — *E. Pallasi* auct. Kom. Fl. Mandsh. II (1904) 686, non Turcz. — *Tithymalus Komarovianus* Prokh. nomen alter-nativum.

Planta perennis, 8—35(50) cm alta (in anthesi tantum 5—8 cm alta foliis nondum evolutis), glabra vel pubescens, radice 4—7 cm crassa, caulibus 5—28(43) cm altis atque 3—6 mm crassis. Folia basalia squami-

735 **formia**, caulina inferioribus alternis exceptis quina vel quaterna verticillata, internodium supremum 2—9(13) cm longum relinquentia, sessilia, ovato-elliptica vel oblonga, (2) 3—8(9.5) cm longa et (0.8) 1.2—2(3.2) cm lata, obtusa, margine revoluta; ea ramorum sterilium alterna, ad basin cuneata, ovato-lanceolata, 3.5—7 cm longa, 1.2—1.7 cm lata. Pedunculi supremi primarii 5, glabri vel ciliati nonnunquam dense [in anthesi 1.5—5 cm longi et in fructificatione usque ad 5—13 cm elongati], apice trifidi, dein interdum bifidi, in anthesi condensati, cum fructibus autem pl. m. divaricati; foliis involucrialibus ovatis vel lanceolatis, (2.5) 3—7.5(8) cm longis et 1.4—2.5(4) cm latis; involucri cellorum folioliss basi subcordata triangulari-deltaeideis inferioribus ternis 2.2—4.5(5) cm longis et 2—3.5(4.5) cm latis, acutis; cyathii involucri hemisphaericum, extrinsecus glabrum, 4—5 mm dimetiens, lobis magnis (1.5—2 mm), nectariisque reniformibus, extus pubescentibus; styli ca. 1.5 mm longi; tricoccum globoso-ovatum, 6—7 mm longum, ciliatum vel glabratum, pericarpio indurato coccis tenuiter corrugatis; semine compressae ovato 3—4 mm longo levi caruncula ovato-conica extrinsecus sulcata. Floret Aprili exeunte et Majo ineunte.

Habitat: in silvis montanis terrae Ussuriensis URSS.

Typus: in vicinitate oppidi Vladivostok, ad stationem Sedanka, in silva mixta. 19(6) V 1911, fr. imm. n° 458. A. Schoschin. — In herbario Instituti botanici nom. ac. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: Haec species cum *Euphorbia Pallasii* Turcz. cui certe proxima est et cui etiam a clarissimo Komarovio relata est adhuc assidue confundebatur. Nihilominus *Euphorbia Komaroviana* ab *Euphorbia Pallasii* ob stylos subduolo breviores, cyathii involucri non pubescens, folia ramorum sterilium deorsum cuneata pedunculos supremos primarios internodiaque superiora nonnunquam eximie elongata speciem distinctam cum area et ecologia proprio sistit.

42. Subsect. **Lutescentes** Prokh., sectionis *Tulocarpa* subsect. n.

Stylis ad tertiam vel partem usque medium inter se coalescentibus apice saepe dilatato crasse bilobis, foliis involucellorum nonnunquam etiam involucralibus haud raro pl. m. flavescentibus. — Typus subsectionis: *Euphorbia pilosa* L.

43. **E. Eugeniae** Prokh. sp. n. — *Tithymalus Eugeniae* Prokh. nomen alternativum.

Planta perennis, 40—65 cm alta, glabra, caulibus erectis parte inferiore simplicibus 4—6 mm dimetientibus sursum costati-striatis ramosissimis vulgo nonnullis pedunculis axillaribus 3—5 cm longis, infra ramulis sterilibus foliatis numerosis 10—16 cm longis inflorescentiam interdum excedentibus, foliis caulinis sessilibus, e basi breviter cuneata oblonge obovatis vel oblonge ellipticis, 3.5—7(18) cm longis, supra medium latioribus, 1—2.2 cm latis (plerumque 3—5-plo quam lata longioribus) apice rotundatis obtusis integerrimis membrana-

736 ceis uninerviis, ramulorum steriliū 1.5—4.3 cm longis et 0.5—1.1 cm latis. Pedunculi supremi haud bene conspicui 3(5), tenues, sicut ei axillares apice trifidi vel bifidi, dein interdum etiam bifidi, folioliss involucralibus rhombico-ovatis, 1—2.5 cm longis, 9—13 mm latis obtusis, foliisque involucellorum ternis vel saepius binis ellipticis 10—17 mm longis, (4) 6—9 mm latis (vulgo sesqui quam lati longioribus); involucrum campanulatum, 2—2.5 mm longum et dimetiens, glabrum intus pilosum, lobis rotundis (1 mm dimetientibus) obtusis glabris nectariisque 4 transverse ellipticis flavidis; styli 1—1.5 mm longi, fere ad medium connati, crasse bilobi; tricoccum depresso globosum, 3—3.5 mm longum, 3.5—4.5 mm latum, haud profunde trisulcum, glabrum, dorso loborum parte superiore processibus satis longis compressis conicis laxè dispersis, semine ovato 2.2—2.5 mm longo 1.7—2 mm lato levi nitido atrifusco, caruncula parva convexa reniformi brevistipitata. Floret Junio et Julio, fructificat Augusto.

Habitat: Abchazia, prope Krasnaja-Poljana in monte Atchishkho prato subalpino. 10 VIII 1946. E. Pobedimova. Clarissimae Eugeniae Pobedimovae quae typum hujus speciei legit hanc speciem dedico. Typus in herbario Instituti Botanici nom. acad. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: *Euphorbiae palustri* L. proxima est, tamen haud aegre dignoscitur tricocco subgloboso vix depresso non profunde sulcato minore (3.5 mm non longiore), dorso coccorum parte superiore processibus pectinatiformibus haud dense consperso, involucro minus dilatato (non plus 2.5 dimetiente), pedunculis supremis tantum 3—5, trifidis vel bifidis, foliis caulinis pl. m. oblongis, non rhombicis, plus triplo quam lata longioribus, caulibus ad basin 4—6 mm. dimetientibus staturaque humiliore (non plus 65 cm).

44. *E. tauricola* Prokh. sp. n. — *E. pilosa* auct. M. B. Fl. taur.-cauc. III (1819) 328, syn. excl., non L.; Boiss. Fl. or. IV. 1906, pp. — *Tithymalus tauricola* Prokh. nomen alternativum.

Planta perennis, 30—80 cm alta, radice descendente 2—3 cm crassa apice multicapiti, caulibus pl. m. numerosis erectis 30—75 cm altis basi 3—5 mm dimetientibus sulcati-striatis glabris, superiore parte atripurpureis et pl. m. ramosis, pedunculis axillaribus 2—8, (1) 1.8—7.5 cm longis, atque deorsum non raro ramis sterilibus 2—5, 0.5—4 cm longis, inflorescentiam non superantibus, sed interdum nullis, haud dense foliatis (internodiis 0.5—2 cm longis), parte inferiore denudatis tantum cicatricosis. Folia basalia squamiformia vaginata triangularia, caulina autem subpetiolata, e basi rotundata vel subcordata elliptica vel oblongo-elliptica, 3.3—6 cm longa, e medio magis dilatata, 1.4—2.5 cm lata, longitudine latitudinem tantum duplo usque triplo excedente, obtusa, margine praesertim prope apicem minute acute serrulata, membranacea, pinnatinervia, supra pilis solitariis serius calvescentia, subtus omnino sed praecipue secus marginem nervosque disperse pilosa. Pedunculi supremi 5, 1.5—3.5 cm longi, sicut ei axillares apice trifidi dein

737 *bindi*: foliis involucribus rotunde oblongis, 1.5—2.6 cm longis, 1.1—1.7 cm latis: involucellorum foliis e basi rotundata rotunde-ellipticis vel rotunde obovatis vel nonnunquam plene rotundis, obtusis glabris in anthesi flavidis, inferioribus ternis, 1.1—1.6 cm longis, 0.8—1.5 cm latis, superioribus autem binis, diminutis; cyathii involucrum campanulatum, 2.5—3 mm longum, extrinsecus glabrum, intrinsecus villosum, lobis oblongis obtusis glabris, nectariisque 4 transverse ellipticis flavidis; stylis (1.5) 2—2.5 mm longis, basi connatis, bifidis; tricoccum depresso globosum, 4—4.5 cm longum, 4.5—5 mm latum, trisulcatum, sat leve, in statu juvenili dense patentim longiciliatum, serius gradatim calvescens, cito dehiscens; semen ovatum leve, caruncula non conspicua discoidea. Floret aprili exeunte et maio, fructificat junio et julio. (Vide tab. XIX, f. 4).

Habitat: in declivibus montanis Tauriae australis in fruticetis nec non marginibus silvarum.

Typus: Tauriae in montibus, Belbek ad marginem silvae 26 (14) V 1898, fl. K. Golde.—In herbario Instituti botanici nomine acad. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: *Euphorbiae carpaticeae* Włoszcz. proxima est, tamen dignoscitur statura plerumque brevior foliis caulinis minus elongatis, duplo usque triplo (nec $2\frac{1}{2}$ —4-plo) longioribus quam lata, ad medium (nec supra) dilatatis, basi non cuneatis, sed pl. m. rotundatis et praesertim involucellorum foliolis suborbiculatis fere aequae longis ac latis (non sesqui usque duplo quam lati longioribus).

45. Subsect. **Purpuratae** Prokh., sectionis *Tulocarpa* subsect.

Stylis inter se subliberis, interdum tantum basi vix coalitis apice pl. m. profunde bifidis, haud incrassatis, foliis involucellorum nonnunquam etiam involucribus saepe pl. m. purpurascentibus.—Typus subsectionis: *Euphorbia dulcis* L.

46. Subsect. **Tibeticae** Prokh., sectionis *Chylogala* subsect. n.—Generis *Tithymali* subgen. *Chylogala* Prokh. Consp. Tith. As. med. (1933) 57, p.p.—Typus subsectionis: *Euphorbia tibetica* Boiss.

Seminis caruncula satis parva, erecta vel reclinata, ipso semine multo minore; involucrum lobis emarginatim bilobis nectariisque 5 transverse oblongis ecornutis vel longe bicornutis; caules ramosi, rarius simplices, plerumque satis sparse foliosi, foliis incise dentatis membranaceis.

47. Sect. **Murtekias** (Raf.) Prokh. ampl., sect. comb. nova.—*Murtekias* Raf. Fl. tellur. (1838) 116, ampl.—Generis *Tithymali* subgen. *Murtekias* Prokh. Consp. Tith. As. med. (1933) 206, ampl.—Generis *Tithymali* sect. *Conicocarpus* Prokh. ibid. 155.—Typus sectionis: *Euphorbia myrsinites* L.

Folia pl. m. crassa, nervis haud raro parum conspicuis digitatis tantum tribus mediis nonnunquam pro parte parallelis saepe densa; nectaria retusa

738 sine cornibus vel pl. m. **bicornuta**; semen albescenti-cinereum parce leviter foveolatum vel vermiculati-rugosum vel leve caruncula pl. m. conica saepe suberecta et brevistipitata.

48. Subsect. **Paralioideae** Prokh., sectionis *Murtekias* subsect. n. Huc spectat *Euphorbia paralias* L.

Tricoccum rapiforme depressum conspicue multo latius quam longum, profunde trisulcatum coccis convexis; semine pl. m. orbiculato, non compresso albido sublevi caruncula parva; stylis subliberis; pedunculis supremis 3 vel 5; folia caulina inferiora obtusa, non mucronulata.

49. **E. stepposa** Zoz, sp. n. — *E. glareosa* M. B. var. *elator* M. B. Fl. taur.-cauc. III, 325. — *E. glareosa* auct. Fl. ucr. non M. B. — *E. pannonicus* auct. Fl. ucr. non Host.

Perennis; radix crassa, multiceps; caules numerosi, 20—60 cm alti, crassiusculi, 3—7.5 mm diametro, foliiscum glabri, griseo-virides, basi interdum papilloso, folia oblanceolata, spatulata, oblonga, oblongo-obovata vel elliptica, 2.2—9.2 cm longa, 4—21 mm lata, basi rotundata, apice obtusa, margine levia, sub apice serrulata, coriacea, 3—5-nervia. Umbella 7—13-radiata, ramis divaricatis, multibifurcatis, involucri folia lanceolato-elliptica oblonga vel subovata, 1.6—4.8 cm longa, 9—14 mm lata, involucelli foliola cordato-reniformia, superiora rotundato-rhomboidea, 5—18 mm longa vel ata, mucronata, margine levia; cyathus tubuloso-campanulatus, ca. 1.75 mm longa, glaber; glandulae semirhomboideae, retusae; capsula ovoidea, 2.75—3.75 mm longa, minutissime verruculosa; semina ovata, 2—3 mm longa, ca. 1.3 mm lata, cinereo-viridia, brunneo-maculata. Fl. VI—VII.

Habitat: in steppis, declivibus stepposis, calcareis vel cretaceis.

Typus: Ucr. SSR, prov. Staliniensis, distr. Rovenski. Provalje in steppe reservata, ad marginem querceti. 18 VII 1934. Leg. V. Artemczuk; in herb. Universit. Charjov conservatur.

E. pannonicæ Host. affinis, sed caulibus elatioribus foliis glabris, umbella divaricata recedit, praeterea habitatione discrepat. Ab *E. glareosa* M. B., quae planta taurica est, statura robustiore, glabritie, foliis margine levibus, umbella multiradiata et seminibus recedit.

50. **E. Goldei** Prokh. sp. nova — *Tithymalus Goldei* Prokh. nomen alternativum.

Planta perennis 15—27 cm alta grisei-glaucula parte superiore pl. m. flava paulum velutina radice descendente cylindrica 0.5—1.5 cm crassa supra multicipiti caulibus pluribus ascendentibus 15—20 cm longis, teretibus parte inferiore denudatis pl. m. dense cicatricosis 2—4 mm dimetientibus, supra pedunculis axillaribus 1—5 (2—4.5 cm longis), interdum sine his et semper sine ramis sterilibus, foliis caulinis sessilibus e basi rotundata vel subangustata oblongis vel ellipticis, 1.8—3.3 (4.5) cm longis 0.6—1.8 mm latis, vulgo duplo

739 usque triplo longioribus quam lata obtusis non raro subito pl. m. rostratis margine anguste marginato superiore parte minute serrulatis coriaceis digitatim 3—5-nerviis nervo medio foliorum ad mucronem rostriformem percurrente. Pedunculi supremi 5—8, 1.5—4.5 cm longi, sicut axillares apice semel bis bifidi, foliis involucralibus e basi rotundata ellipticis vel rotundati-ellipticis vel suborbiculatis, (0.8) 1.2—3.2 cm longis (0.5) 0.8—2 cm latis pl. m. (promore sesqui) longioribus quam lata, obtusis haud raro rostratis, vix serrulatis, digitatim 3—5-nerviis nonnunquam paulum flavidis, foliis involucellorum binis e basi truncata vel non profunde cordata reniformibus, 6—10 mm longis 8—15 mm latis plerumque usque sesqui latioribus quam longi obtusissimis interdum scabridis, tantum nervo medio in mucronem rostriformem (0.5—1 mm longum) prominente, flavidis coriaceis; involucrum campanulatum circa 2 mm longum 2.5—3 mm dimetiens intrinsecus pubescens lobis ovatis obtusis denticulatis vel emarginatis, nectariisque semilunaribus retusis ecornutis; stylis 2—2.5 mm longis, ad tertiam partem connatis bifidis; tricoccu n conico ovatum 3—4 mm longum, 2.5—3.5 mm latum, leviter trisulcatum coccis rotundatis minutissime tuberculatis; semine compresse ovato circa 2.5 mm longo et 1.5 mm lato levi minute fuscimaculato, caruncula obtuse conica subreclinata. Fl. junio exeunte et julio ineunte, fructificat julio et augusto ineunte.

Habitat: in Tauro pontico in montosis Jaila dietis in declivibus.

Typus: Tauria, prope Jaila ad tabernaculam. 21 (8) I 1904, fl. K. Golde. Clar. K. Goldei investigatori Tauri infatigibili hanc speciem dedico. Typus in herbario Instituti botanici nom. acad. V. I. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: ab *Euphorbia glareosa* Pall. ex M. B. cui proxima est discrepat foliis caulinis magis dilatatis, non plus triplo quam lata longioribus, apice eximie rotundatis, pedunculis supremis 5—8, foliis involucralibus rotundatis ellipticisve abrupte mucronulatis, longitudine latitudinem non plus sesquo excedente, necnon foliolis involucellorum basi truncata vel breviter cordata semiorbiculati-reniformibus, obtusissimis et ob nervum medium excedentem egregie rostratis (rostro usque 1 mm longo), saturateque flavescentibus.

51. **E. monostyla** Prokh. sp. nova. — *Tithymalus Marschallianus* auct. Prokh. Consp. Tith. As. med. (1933) 206. — *Euphorbia Marschalliana* auct. Prokh. ibid. non Boiss. — *Tithymalus monostylus* Prokh. nomen alternativum.

Planta perennis, 20—50 cm alta, glabra glauca, parte superiore non raro rubescens, radice 1—2 cm crassa longa supra multicipiti, caulibus numerosis ascendentibus 5—10 mm crassis deorsum subattenuatis pl. m. sulcatis simplicibus tantum parte superiore nonnunquam pedunculis axillaribus 2—8, 2.5—3 cm longis, usque ad medium denudatis cicatricosis (cicatricibus usque 3 mm), non florentibus hibernantibus atque anno altero florere incipientibus, foliis caulinis densissimis (4—5-plo et magis internodia superantibus), ab infimis ad media crescentibus et denuo ad suprema decrescentibus, sessilibus, basi longe cuneata (praeter suprema) rhombe obovatis, 1.3—4(4.5) cm

740 longis, 5—12(15) mm latis, pl. m. acuminatis, margine anguste cartilagineis, subintegerrimis carnosis subnerviis. Pedunculi supremi 10—16(19), 1—2.5 cm longi crassi costati-striati, sicut ei axillares apice semel bis bifidi, foliis involucribus caulinisque supremis rhombico obovatis vel spathulate oblongis vel interdum suborbiculatis, 8—15 mm longis, 5—10 mm latis, subito mucronulatis, margine anguste cartilagineo leviter minute dentatis, foliis involucrium binis, basi sessili subamplexicauli rotundis vel rotundatim reniformibus, concavis obtusis interdum mucronulatis, subintegerrimis, saepe rubescentibus inferioribus 5—10 mm longis et latis; cyathis, involucrium 2—3 mm longum atque dimetiens, lobis magnis rotundi spathulisve (1.5—2.5 mm latis) denticulatis rubridis, nectariisque transverse oblongis (2—3 mm longis) fuscis bicornutis, cornibus spathulatis sursum dilatatis nectarii latitudini aequilongis; styli 1.5—2 mm longi, tribus quartis partibus inter se connatis, subintegris, stigmatibus vix bilobis; tricoccum truncatim trigonum, 4.5—5.5 mm longum, 4—5 mm latum, supra impressum, leve, lobis obtuse carinatis, non sulcatum, semine oblongo 3.5—4 mm longo quadrigono sublevi albido caruncula parva erecta retusa conica apice foveolata rubrida. Floret primo vere mense martio, fructificat jam aprili.

Habitat: in lapidosis schistosisque et locis saxosis jugi Kopet-dagh necnon montium Balkhany magnorum.

Typus: Turcomania, montibus Balkhany magnis, prope stationem viae ferreae Dzhebel, 28(15) III 1912, fr. imm. n° 4020. N. Androsov. — In herbario Instituti botanici nom. acad. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: Haec species a ceteris subsectionis *Myrsiniteae* speciebus satis bene discrepat. Foliis longis acuminatis integerrimis atque seminibus levibus *Euphorbiae biglandulosae* Desf. sic appropinquat ut eam etsi non indubie ad unam eadem seriem hic referimus. Nihilominus ab *Euphorbia biglandulosa* nostra species ob pedunculorum supremorum numerum auctum (plus quam 10, usque 19), etiam eos axillares praesentes numero 2—8, folia caulina minus elongata non plus quadruplo longiora quam lata, folia involucrium suborbiculata, inferiora non plus 10 mm longa sua longitudine fere aequilata, involucrium tantum 2—3 mm dimetiens, ad longitudinis tres quartas partes inter se connatas et seminis carunculam retuse conicam supraque profunde concavam satis longe distare videtur.

52. *E. pontica* Prokh. sp. nova. — *Tithymalus ponticus* Prokh. nomen altern. — *E. pectinata* auct. fl. cauc. non Alboff, 1894.

Planta perennis 15—35 cm alta glabra cinerascens-atrividua pl. m. rubrida, radice longa descendente supra multicapiti, caulibus pl. m. numerosis ascendentibus sterilibus atque florentibus 3—5 mm crassis, basin versus se attenuantibus, simplicibus, nonnunquam apice tantum uno pedunculo axillari, foliis caulinis densis (4—8-plo internodia excedentibus), oblonge obovatis, (1.2) 1.4—2.5 (3.6) cm longis, 0.6—1.2 (1.7) cm latis, longitudine latitudinem

741 2—3-plo superante, acuminatis, margine elevatim marginatis, subintegerrimis, crassis, nervis inconspicuis. Pedunculi supremi 5—12, 1—2 (4) cm longi, simplices vel apice semel bis bifidi, foliis involucralibus sessilibus rotunde vel rhombeo obovatis vel oblongis, 0.9—1.6 (2.7) cm longis, 0.5—1.4 (1.6) cm latis, longitudine latitudinem pl. m. (usque duplo) excedente, subito brevi mucronulatis, integerrimis, foliolis involucrorum sessilibus basi pl. m. rotundata (haud cordata) inferioribus rotundatim vel rhombeo reniformibus, 4—6 (10) mm longis, (5) 6—14 (15) mm latis, obtusis tantum raro vix mucronulatis integerrimis, superioribus diminutis suborbiculatis obtusis, in fructificatione eximie rubris; cyathii involucrum campanulatum, 3—3.5 mm diametens, lobis rotundis (1—1.2 mm latis) albidis denticulatis, nectariisque semilunatis bicornutis cornibus e substantia involucri spathulatis plerumque nectarii latitudine haud longioribus; styli 1.5—2 mm longi, ad medium connati subintegri, stigmatibus, vix bilobis; tricocum trigono-ovatum, 4.5—5.5 mm longum, 4—5 mm latum, apice retusum, trisulcatum, lobis obtuse carinatis; semine albido oblongo 2.8—3 mm (sine caruncula) longo rotundatim tetragono vermiculatim rugoso caruncula erecta retuse conica supra foveolata brevistipitata. Floret aprili, fructificat majo.

Habitat: in declivibus lapidosis Armeniae turcicae atque Anatoliae boreali-orientalis.

Typus: districto Artvin ad Ardanutsh in monte Vartskhet declivitate lapidosa. 8 VI (26 V) 1914, fr. S. Turkevicz.

Affinitas: Aemulatur haec species *Euphorbiam myrsinites* L. quacum semine stylisque congruit. Ab hac autem discernitur foliis caulinis oblonge oblanceolatis plus duplo quam lata longioribus pl. m. acuminatis sed non mucronatis, fere integerrimis, involuclorum foliis e basi non cordata infimis pl. m. reniformibus latitudine longitudinem paulum excedente, supremis autem suborbiculatis saepe rubridis atque totae plantae colore griseo-viridi, haud glauco.

53. **E. armena** Prokh. sp. n.—*Tithymalus armenus* Prokh. nomen alternativum.

Planta perennis humilis glabra, glauca, radice ramosa supra multicipiti, caulibus pl. m. numerosis, sterilibus et florentibus, ascendentibus, (10) 15—25 (30) cm longis, 4—5 mm crassis, basi pl. m. ramosis surculis lateralibus ceterum simplicibus tantum apice pedunculis axillaribus 1—3 (2.5—4.5 cm longis), interdum sine his, dense foliosis, basi autem denudatis cicatricosis, foliis caulinis sessilibus, e basi cuneata rhombeo obovatis vel rarius spathulatim obovatis, 12—28 (35) mm longis, 6—16 (20) mm latis, vulgo sesqui usque duplo quam lati longioribus subito mucronatis, margine anguste cartilagineis inconspicue minute scabride serrulatis, carnosius obscure nervosis. Pedunculi supremi (4) 5—7, (1.5) 2—5 cm longi, sicut ei axillares apice semel bisve bifidi, foliis involucralibus orbicularibus vel rhombeo ovatis, 9—18 mm longis, 8—19 mm latis, sua latitudini fere aequilongis vel rarius ea

742 usque sesqui longioribus, obtusis, nonnunquam subito pl. m. mucronulatis, margine angustissime cartilagineisplerumque subintegerrimis, foliolis involucellorum binis, e basi pl. m. profunde cordata reniformibus vel triangulari-reniformibus (5) 8—15 mm longis, (7) 11—21 mm latis, latitudine longitudinem paulo vel saepius sesqui excedente, obtusis, nonnunquam subito vix mucronulatis, subintegerrimis; cyathi involucrum campanulatum, 3—3.5 mm dimetiens, lobis magnis (1.5—2 mm) rubridis rotundis scabridis, nectariisque transverse oblongis (2—3 mm longis) bicornutis cornibus e substantia involucri albidis spathulatis nectarii latitudine vix longioribus; styli 2—2.5 mm longi ad medium connati, bilobi; tricoccum trigono-ovatum, 5—6 mm longum, 4.5—5.5 mm latum, subretusum leve paulo sulcatum coccis acute costatis; semine albido oblongo circa 3 mm longo tetragono, sublevi vel vix corrugato, caruncula magna conico ovata (circa 1.5 mm longa) acuta longitudinaliter plicata pedicellata. Floret aprili et majo, fructificat majo et junio.

Habitat: in Armenia in steppis siccis lapidosis atque declivibus lapidosis.

Typus: Armenia, Etchmiadsin prope Erevan. 8 V (25 IV) 1910, fl. A. Grossheim. In herbario Instituti Botanici nom. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: *Euphorbiae Marschallianae* Boiss. speciei talyshensi proxima est, sed ab hac discrepat pedunculis supremis non plus quam 7, saepe conspicue longioribus non raro bis bifidis, involucellorum foliolis basi profunde cordata reniformibus plerumque sesqui latioribus quam longa eis infimis vulgo quam 8 mm longioribus et quam 11 mm latioribus, foliis caulinis subintegerrimis necnon stylis usque ad 2.5 mm longis.

54. **E. Borszczowii** Prokh. sp. n. — *Tithymalus Borszczowii* Prokh. nomen alternativum.

Planta perennis 20—30 cm alta glabra cinerascens, caulibus e basi ascendente erectis striati-costatis parte inferiore 2—3 mm dimetientibus tantum usque ad $\frac{1}{3}$ — $\frac{1}{2}$ omnis altitudinis simplicibus, supra ramosissimis primo ramulis sterilibus 2—3 (raro usque 11) dense foliosis haud raro inflorescentiam excedentibus, dein pedunculis axillaribus 4—13 circa 3.5 cm longis; foliis caulinis sessilibus e basi pl. m. rotundata late linearibus 1.8—3.5 cm longis, 2.5—8 mm latis ($4\frac{1}{2}$ —9-plo longioribus quam lata) obtusis vel acutis vel abrupte truncatis integerrimis margine revolutis uninerviis, eis ramorum sterilius anguste cuneatim spathulatis 1.4—3 cm longis ad apicem magis dilatatis, 2.5—6.5 mm latis (4—10-plo longioribus quam lata) plane truncatis tantum in medio aliquando vix mucronulatis, rarius non truncatis, obtusis acutiusculisve. Pedunculi supremi 7—10, 2.5—4.5 cm longi, sicut axillares apice semel vel bis bifidi, interdum serius ramulos steriles edentes, foliis involucralibus basi subdilatata rotunda lineari spathulatis vel oblonge-ovatis, 0.8—2 cm longis, 2—5 mm latis (3—6-plo longioribus quam latis), obtusis vel truncatis, foliolis involucellorum binis rhombo vel rarius rotundatim

743 reniformibus obtusis, inferioribus 5.5—8 mm longis et (7) 10—12 mm latis (plerumque sesqui latoribus quam longa); involucrum campanulatum, 2—2.5 mm longum atque dimetiens, lobis oblongis obtusis, nectariisque atratis breviter bicornutis; stylis circa 2 mm longis, ad tertiam partem coalitis profunde bifidis; tricoccum et semen ignota.

Habitat: in steppis declivibusque montium tractu inter fluvium Volgam et montes Uralenses.

Typus: Distr. Novouzensk. 1859. Borszczow.

Affinitas: haec species foliis caulinis involucralibusque *Euphorbiam sareptanam* A. Beck. admonet, sed caulibus parte superiore ramosis foliis cuneati spathulatis, non obovatis, apice truncatis, nunquam retusis, pedunculorum superiorum numero aucto, stylis multo longioribus longe distat. Ad *Euphorbiam subcordatam* Ldb. propius accedere videtur, sed foliis omnino diversa est.

55. Subsect. **Sieboldianae** Prokh., sectionis *Esula* subsect.

Involucellum foliolis liberis basi dilatatis; caules ramis sterilibus carentes foliis oblongis. — Typus subsectionis: *Euphorbia Sieboldiana* Morr. et Decne,

56. Subsect. **Patellares** Prokh., sectionis *Esula* subsect. n.

Involucellum foliolis binis pl. m. concretis, unam patellam formantibus. — Typus subsectionis: *Euphorbia amygdaloides* L.

57. Sect. **Cymatospermum** Prokh. sect. n. — Generis *Tithymali* sect. *Cymatospermum* Prokh. Consp. Tith. As. med. (1933) 151, ampl.

Cyathi involucro minus quam 1.5 mm dimetiente, nectariis cornibus e substantia involucris; pedunculi supremi usque ter vel multoties bifidi; semen carunculatum vel ecarunculatum, tetragonum vel hexagonum, plicatim corrugatum vel profunde sulcatum vel tuberculatum vel reticulatum profunde foveolatum sed nunquam leve; plantae annuae radice tenui. — Typus sectionis: *Euphorbia falcata* L.

58. Subsect. **Oleraceae** Prokh., sectionis *Cymatospermum* subsect. n.

Folia caulina et folia involucralia basi cuneatim angustata, raro pl. m. auriculata; nectaria cornibus e substantia involucris tenuibus elongatis rarius brevibus; styli breves vel longi; caules ob bases ramosas saepe pl. m. numerosi, haud raro etiam surculis lateralibus foliatis. — Typus subsectionis: *Euphorbia peplus* L.

59. Subsect. **Densiusculae** Prokh., sectionis *Cymatospermum* subsect. n.

Foliola involucellorum transverse oblonga vel late ovata, nonnunquam bina uno latere pl. m. connata, pl. m. obtusa, integerrima; nectaria cornibus nectario aequilongis e substantia involucris; styli satis longi; tricoccum trigono-ovatum, magnum (ca. 4 mm longum); semen tetragonum ecarunculatum; planta

744 humilis, pl. m. patentim pilosa. — Typus subsectionis: *Euphorbia densiuscula* M. Pop.

EMPETRUM L.

60. *E. kurilense* V. Vassil. sp. n. — *E. nigrum* auct. Fl. ins. Kuril. non L.

Fruticulus dioicus, ramis brevibus, ramosissimis ad terram appressis. Ramuli hornotini stipitatum glandulosi, pilis fuscis crispis vestiti. Folia linearia verticillata vel subverticillata dense disposita, pro parte magne ad basin ramulorum vergentia; folia nitida, 2.5—5 cm longa, 1 mm lata. Flores solitarii in ramulis abbreviatis axillaribus, dioici, parvuli, basi bracteis squamiformibus numero 4 compacto accumbentibus, imbricato dispositis vestiti; sepala 3, late-ovata valde concava, argyllacea, marginibus lucidis, subintegerrima; petala 3, rosea (vel purpurea), obovata, apice rotundata, paullo denticulata, ca. 3 mm longa, 1.5 mm lata; stamina 3 tepalis alterna, filamenta staminum plana, ca. 8 mm longa; antherae biloculares purpureae, ca. 1 mm longae. Fructus niger.

Typus: Insulae Kurilenses. Ins. Kunashir. Litora sabulosa. Inter lichenem, bryophitam cum Vaccinio vitis idaeo saepe occurit. 2 VII 1946. Leg. D. P. Vorobjev.

Ad *E. sibiricum* m. proximum est. Ab *E. sibirico* ramis brevibus, foliis dense dispositis, nitidis, valde differt.

EUONYMUS L.

61. Sect. 4. *Kalonymopsis* Prokh. sect. n.

Staminum filamentis inconspicuis antherisque subsessilibus; corolla pl. m. purpurea; capsula pl. m. quadriloba, nunquam globosa et partita; seminibus tantum partim arilla tectis; rarius non raro pl. m. verrucosis; foliis vulgo oppositis, sed raro verticillatis et alternis.

KALONYMUS (G. BECK) PROKH.

62. *Kalonymus* (G. Beck) Prokh. gen. n. — Generis *Euonymi* subgen. *Kalonymus* G. Beck. Fl. v. Nied.-Oesterr. (1892) 588. — Generis *Euonymi* sect. *Uniloculares* Rouy et Foucaud, Fl. Fr. IV (1897) 159.

Flores pentameri. Stamina filamentis tuberculiformibus subnullis antheris ob pollinaria confluentia unilocularibus. Ovula atque semina pendula. — Typus generis: *Euonymus latifolia* Mill.

63. *K. Maximowicziana* Prokh. sp. n. — *Euonymus Maximowicziana* Prokh. nomen alternativum. — *E. sachalinensis* auct. Maxim. p.p. (quoad foliorum characteres, speciminibus sachalinensibus exceptis) in Bull. Acad. Sc. Pétersb. XXVII (1881) 446, non *E. sachalinensis* (F. Schmidt) Maxim.

Frutex ad 3 m altus trunco ad 5 cm crasso ramis divaricatis haud raro inflexis non longis, illis annotinis longitudinaliter sulcatis, 1—2 mm dimetientibus, vetustioribus autem crassis cylindricis 2—5 mm dimetientibus glabris atrifuscis hic inde lenticellis albidis sparsis corticisque fuscidi lamellis, gemmis autumnno magnis fusiformibus, 8—20 mm longis acuminatis. Folia basi rotunda vel brevicuneata elliptico-rhomboidea vel ovata, rarius oblongo-ovovata, 3.5—11.5 cm longa, vulgo infra medium dilatata, 2—6 cm lata, apice pl. m. longe mucronata, manifesto sed plerumque inaequaliter fimbriatim serrata, dentibus erosiscabridis membranacea glabra subtus pallidiora, petiolis 4—9 mm longis. Cymae 15 (rarius 3)-radiatae, (3) 9—21-florae quae non plus quam 3 capsulas evolvunt pedunculis (2) 5—9 cm longis haud tenuibus ex axillis ramuli foliorum inferiorum iis subaequilongiorum aut perularum delapsarum, pedicello medio indiviso, lateralibus ei proximis semel aut raro bis bi-vel trifidis, extremis autem simplicibus, raro apice semel fissis, bracteis deciduis. Flores plerumque pentameri, comparate parvuli, 4—5 mm dimetientes; petalis oblongo-rotundatis 1.5—2 mm longis viridescenti-albis margine pl. m. convolutim undulatis; antheris staminum subsessilibus, stylo valde curtato retuso stigmate discideo, ovario subconvexo flavido. Capsula demissa, globosa, depressa, stellatim pentagona, 7—12 mm longa, 10—17 mm dimetiens, apice convexa, basi plana, alis 5, raro 4, brevibus rotundati-triangularibus subdemissis dimidiam loculi longitudinem non excedentibus, levis atriaurantiacifusca; seminibus oblongis, 6—7 mm longis, arillo flavido tectis.

Habitat: in saxosis litoralibus regionis austro-ussuriensis in silvis et fruticetis.

Typus: Oriente extremo, Terra austro-ussuriensi, circa sinum Possiet in fruticetis ad latera lapidosa collium 19 VII 1860, fr. imm. Maximowicz. In herbario Instituti botanici nom. acad. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: a *K. latifolia* (Mill.) Prokh. cui proxima est bene discrepat foliis longe mucronatis vulgo inaequaliter serratis dentibus erosio scabridis pedunculis haud tenuibus strictis, ac capsulae alis rotundati-triangularibus subdemissis. A *K. sachalinensi* (F. Schmidt) Prokh. autem quocum saepe confundebatur cymis multifloris petalis viridescenti-albis non purpureis foliisque non crenatis sed serratis sat longe distat.

64. *K. sachalinensis* (F. Schmidt) Prokh. comb. n. — *Euonymus sachalinensis* (F. Schmidt) Maxim. p.p. (quoad florum characteres et specimina sachalinensia) in Bull. Acad. Sc. Pétersb. XXVII (1881) 446, nomen alternativum. — *E. latifolia* var. *sachalinensis* Fr. Schmidt.

Frutex ramis teretibus striatis fuscis glabris, gemmis autumnno grandibus fusiformibus 5—22 mm longis acuminatis. Folia e basi cuneata vel non raro (majora) rotundata obovata vel elliptica, 3—11 cm longa, vulgo supra medium dilatata, 2—9 cm lata, apice retusa vel rotundata vel breviter obtuse apiculata,

746 *grosse crenata* dentibus rotundatis iterum serrulatis, membranacea, glabra; petiolis 5—10 mm longis. Cymae plerumque simplices, 3-(rarius 2 vel 4)-radiatae (raro tantum radices singulis, bifidis), 2—4-florae, pedunculis 3—6 cm longis tenuibus pendulis binae rarius quaternae ex axillis perularum delapsarum, folia supraposita ad duplo superantes, bracteolis pedunculi subulatis pedicellorum autem deciduis. Flores pentameri, (5) 8—10 mm dimetientes; petalis spathulati-obovatis, cuneatim unguiculatis obtusis purpureis; staminibus antheris subsessilibus; stylo curvato obtuso stigmate subsessili; ovario subconvexo. Capsula globosa depressa stellatim quinqueloba 8—12 mm longa 19—25 mm dimetiens, apice convexa, basi plana, loborum alis rotundati-oblongis loculo haud longioribus; seminibus arillo aurantiaco omnino vestitis.

Habitat: in silvis montanis praecipue coniferetis in insula Sachalin.

Typus: Oriente extremo, insula Sachalin, ad custodiam Duz. 24 (12) VI 1860, fr. imm. F. Schmidt. In herbario Instituti botanici nom. acad. V. L. Komarovi Ac. Sc. URSS in Leninopoli conservatur.

Affinitas: vide *K. Maximowicziana* Prokh.

ACER L.

65. *A. Komarovii* Pojark. sp. n.

Arbor parva, ramulis tenuibus cortice lutescente vel purpurascente, gemmis pedunculatis perulis 2 exterioribus praeditis, petiolis tenuibus rubris, foliis membranaceis, 4—10 mm longis, 2—9 cm latis, utrinque glabris, vel subtus ad nervos barbis villosis, ambitu ovatis vel suborbiculatis, basi cordatis, profunde quinquelobis vel trilobis, lobis longe caudato acuminatis, medio valde prominente, marginibus incise vel lobulato-duplicato serratis. Inflorescentia racemosa, pauciflora, glabra, floribus androdioicis, lutescentibus; sepala petalaeque 5, anguste spathulata, obtusa, 3—4 mm longa, stamina 8, disci margine exteriori inserta. Antherae scabrae, late-ellipticae, apiculatae, ovarium glabrum. Samarae 2—2.5 cm longae, sub angulo obtuso divergentes, loculis oblonge ovatis, convexis, tenuiter nervosis, alis marginibus parallelis vel apicem versus dilatatis.

Habitat: in silvis montanis regionis austro-ussuriensis Koreae septentrionalis et Mandshuriae.

Typus: regione austro-ussuriensi, „Kedrovaja padj“, leg. Basargin. In Herb. Inst. bot. Acad. Sc. URSS conservatur.

Differt ab *A. Tschonoskii* Maxim. antheris latioribus, foliis multo incisius margine tenuiter serratis.

IMPATIENS L.

66. *I. Nevskii* Pob. sp. n.

Annua, caule erecto, succoso, glabro, 20—60 cm alt., ramoso; folia late elliptica, acuminata, cuneata, crenulata vel serrulata, margine basi paulo glandulosa, glabra, in petiolum attenuata; petioli 2—3.5 cm longi. Racemi

47 axillares 6—12-flores, folios superantes. Flores 1 cm longi, erecti, longe pedicellati, pallide violascentes, fauce rubro striati. Sepala cordato-ovata integerrima, carinata. Sepalum petaliforme acuminatum, in calcar rectum productum, limbo violascente; petalum superius suborbiculatum, carinatum, apice cucculatum, carina viridi; petala lateralia connata obliqua gibbosa, biloba: lobo inferiore pallide flavo, superiore violaceo; filamenta versus apicem dilatata. Capsula lineari oblonga, cylindrica.

Habitat: in angustiis umbrosis humidis jugorum Kuhitang necnon Tjanschan.

Typus: Turcomania, Jugum Kuhitang, in angustiis prope pag. Kuhitang, leg. S. A. Nevski 4 VI 1931, n° 40.

Nostra species *I. parviflorae* DC. affinis, differt tamen floribus violascentibus sepali petaliformis limbo longiore, petalis lateralibus gibbosis plerumque bilobis.

INDEX ALPHABETICUS*

ordinum, familiarum, specierum atque synonymorum plantarum
in tomo XIV Florae URSS commemoratarum

	Pag.**		Pag.
Acalypha L.	298	Acer <i>eriocarpum</i> Maxim.	620
" <i>australis</i> L.	299	" " <i>Opiz</i>	597
" <i>genuina</i> Spreng.	299	" <i>Fedtschenkoanum</i> Krysh.	594, 595
" <i>ladica</i> L.	299	" <i>ginnala</i> Maxim.	601
" <i>pauciflora</i> Hornem.	299	" " <i>ssp. euginnala</i> Pax	602
Acalyphae Pax, tribus	298	" " <i>Semenovii</i> Pax	603
Acer L.	580	" <i>grahamense</i> Kn. et Cock	583
" <i>abchasicum</i> Rupr.	599	" <i>hederaefolium</i> Fournef.	591
" <i>ambiguum</i> Heer.	583	" <i>Heldreichii</i> Orph.	600
" <i>amurensis</i> Pojark.	583	" <i>hyrcanum</i> C. K. Schneid.	614
" <i>arcticum</i> Heer.	583	" <i>hyrcanum</i> Fisch. et Mey.	613
" <i>australis</i> Kotschy	597	" " <i>var. tomentellum</i> f. <i>neg-</i> <i>lectum</i> cf. f. <i>divarica-</i> <i>tum</i> Maleev	614
" <i>austriacum</i> Tratt.	596, 597	" <i>ibericum</i> M. B.	615
" <i>barbinerve</i> Maxim.	618	" <i>ibericum</i> M. B.	583
" <i>brachyphyllum</i> Heer.	583	" <i>insigne</i> Boiss. et Buhse	597
" <i>Bruckmannii</i> Heer.	583	" " <i>var. Trautvetteri</i> Pax	600
" <i>californicum</i> (Torr. et Gr.) Dietr.	621	" <i>insigne</i> Boiss. et Buhse	583
" <i>campestre</i> L.	596	" <i>insigne</i> Nichols	600
" <i>ssp. hebecarpum</i> DC.	597	" <i>integerrimum</i> Viv.	583
" " <i>lelocarpum</i> Pax	597	" <i>integrilobum</i> O. Web.	583
" <i>campestre</i> var. <i>acutilobum</i> Pax	597	" <i>integrum</i> Bors.	583
" " " <i>austriacum</i> DC.	597	" <i>isolobum</i> Kurz	594
" " " <i>lobatum</i> Pax	597	" <i>italum</i> Schmalh.	613, 614
" " " <i>marsicum</i> C. Koch	597	" " <i>ssp. hyrcanum</i> Pax	613
" " " <i>normale</i> Schwer.	597	" " " " <i>Wolf</i> et <i>Pa-</i> <i>lib.</i>	614
" " " <i>pseudomarsicum</i> Pax	597	" " " " <i>var. acutifo-</i> <i>lium</i> f. <i>tauricola</i> Pax	614
" <i>campestre</i> L.	583	" <i>italum</i> <i>ssp. variabile</i> var. <i>crassifo-</i> <i>lium</i> Pax	613
" <i>carolinianum</i> Walt.	619	" " <i>var. crassifolium</i> Pax	613
" <i>caudatum</i> var. <i>ukurunduense</i> Rehd.	607	" " " <i>euhyrcanum</i> Pax	613
" <i>cinerascens</i> Lipsky	616	" " " <i>hyrcanum</i> Fedtsch. et Fler.	614
" <i>circumlobatum</i> var. <i>pseudosiebol-</i> <i>dianum</i> Pax	608	" " " <i>tauricola</i> Fedtsch. et Fler.	614
" <i>coccineum</i> Mehx. f.	619	" <i>Komarovi</i> Pojark.	611, 746
" <i>colchicum</i> Hartwiss.	591	" <i>laciniatum</i> Loud.	599
" <i>cordifolium</i> Moench	603	" <i>laetum</i> B. Fedtsch.	591
" <i>crispum</i> Lauth	592	" <i>laetum</i> C. A. M.	591
" <i>dasy carpum</i> Ehrh.	620	" <i>laetum</i> C. A. M.	583
" <i>decipiens</i> A. Br.	583		
" <i>dedyle</i> Maxim.	607		
" <i>diabolicum</i> <i>ssp. barbinerve</i> Wes- mael	618		
" <i>Dittrichii</i> Ortmann	599		
" <i>divergens</i> C. Koch	593		
" <i>Drummondii</i> Hook. et Arn.	619		

* [This index has been reproduced photographically from the Russian original.]

** [Russian page numbers appear in the left-hand margin of the text.]

<i>Acer laetum</i> var. <i>colchicum</i> Schwerin	591
" " var. <i>parviflorum</i> Rgl.	590
" " " <i>pliocenicum</i> Sap.	583
" " " v. <i>Regelii</i> Pax	591
" " " <i>intermedium</i> Kuzn.	591
" <i>lasicum</i> Schwer.	593
" <i>lasiocarpum</i> Lév.	607
" " Wimm. et Grab.	597
" <i>latealatum</i> Radde-Fom.	616
" <i>leiocarpum</i> Opiz	597
" <i>Lipskyi</i> Rehd.	591
" <i>Lobelii</i> Bge.	591
" <i>Lobelii</i> Ldb.	591
" " ssp. <i>laetum</i> Pax	591
" " " var. <i>colchicum</i> Pax	591
" " " ssp. <i>pictum</i> Wesmael var. <i>mono</i> Wesmael	590
" <i>Lobelii</i> Tenore	583
" <i>longifolium</i> Loud.	599
" <i>mandschuricum</i> Maxim.	617
" <i>marsicum</i> Guss.	597
" <i>Maximowiczii</i> Pax	611
" <i>mexicanum</i> (DC.) Pax	621
" <i>micranthum</i> S. et L.	611
" <i>Miyabei</i> Maxim.	596
" <i>mono</i> Maxim.	589, 590
" <i>monspessulanum</i> Boiss.	616
" " Ldb.	615
" " var. <i>crenatum</i> Rgl.	594
" " " <i>divergens</i> Radde-Fom.	616
" " " " <i>genuina</i> f. <i>acutiuscula</i> Sinten.	616
" " " " <i>genuinum</i> Krysht.	616
" " " " <i>ibericum</i> C. Koch	615
" " " " <i>pubescens</i> Wesmael	594
" " " " <i>turkestanicum</i> Franch.	595
" " " " " <i>Lipsky</i>	616
" " <i>negundo</i> L.	621
" " " var. <i>pseudocalifornicum</i> Schwer.	622
" " <i>obliquum</i> Pin.	583
" " <i>opalus</i> Hohen.	613
" " <i>opulifolium</i> Ldb.	613
" " " Stev.	614
" <i>Osmontii</i> Kn.	583
" <i>oxytomon</i> Borb.	597

<i>Acer palmatum</i> Thb.	583
" " mut. <i>Nordenskiöldii</i> Nath.	583
" <i>parviflorum</i> Budistch.	608
" <i>pennsylvanicum</i> L.	610
" <i>pentapomicum</i> Sew.	594
" <i>pictoides</i> Baik.	583
" <i>pictum</i> Thunb.	589
" " var. <i>euvictum</i> Pax	589
" " " <i>mono</i> Pax	590
" " " " <i>typicum</i> subvar. <i>eupictum</i> Pax	590
" " " " " <i>mono</i> Pax	590
" " " " v. Maxim.	590
" " <i>pictum</i> Thb. var. <i>fossile</i> Nath.	583
" <i>pilosum</i> Maxim.	594
" <i>platanoides</i> L.	592
" <i>platanoides</i> L.	583
" <i>platyphyllum</i> A. Br.	584
" <i>polymorphum</i> S. et Z. var. <i>miocaenicum</i> Menz.	584
" <i>populifolium</i> Krassn.	584
" <i>pseudolaetum</i> Radde-Fom.	591
" <i>pseudoplatanus</i> C. A. M.	597
" " Falk	592
" <i>pseudoplatanus</i> L.	598
" " var. <i>villosum</i> Parl.	599
" " " f. <i>albo-variegatum</i> Schwer.	600
" " " " <i>argenteum</i> Schwer.	600
" " " " <i>aureo-variegatum</i> Schwer.	600
" " " " <i>crispum</i> Schwer.	600
" " " " <i>erythrocarpum</i> Cass.	600
" " " " <i>Leopoldii</i> Lem.	600
" " " " <i>purpurascens</i> Pax	599
" " " " " <i>pyramidale</i> Nich.	600
" " " " " " <i>subtrilobum</i> Schwer.	599
" " " " " <i>ternatum</i> Schwer.	600
" <i>pseudoplatanus</i> L. var. <i>fossilis</i>	584
" " " aff.	584
" <i>pseudosieboldianum</i> (Pax) Kom.	608
" " " var. <i>ambiguum</i> Nakai	609
" " " " <i>koreanum</i> Nakai	609
" " " " " <i>macrocarpum</i> Nakai	609
" <i>pubescens</i> Franch.	594

<i>Acer pubescens</i> a. <i>genuinum</i> Pax	594	<i>Acer tataricum</i> f. <i>pubigerum</i> Bl.	604
" <i>pubescens</i> Krysh.	595	" " " <i>rotundifolium</i>	
" <i>pycnanthum</i> C. Koch	619	" " " Rac.	604
" <i>quinquelobum</i> Gilib.	599	" " " <i>Slendzinskii</i> Ras.	604
" " C. Koch	593	" <i>tataricum</i> L.	584
" <i>Regelii</i> Pax	595	" <i>tataricum</i> Radde	602
" <i>ribifolium</i> Göpp.	584	" <i>tegmentosum</i> Maxim.	609
" <i>rotundum</i> Dulac	592	" <i>Trautvetteri</i> Medw.	600
" <i>rubrum</i> L.	619	" " f. <i>erythrocarpa</i> Dieck	600
" <i>rubrum</i> W. et K.	603	" <i>trilobatum</i> (Sternb.) A. B.	584
" <i>saccharinum</i> L.	620	" <i>trilobum</i> Gilib.	596
" " f. <i>heterophyllum</i>		" <i>Tschonoskii</i> Maxim.	611
" " Schwer.	621	" " var. <i>rubripes</i> Kom.	611
" " " <i>Wieri</i> Schwer.	621	" <i>turcomanicum</i> Pojark.	616
" <i>saccharinum</i> Wangerh.	612	" <i>turkestanicum</i> Pax	590
" <i>saccharum</i> Marsh.	612	" <i>turkestanicum</i> Pax	584
" <i>sachalinense</i> Heer	584	" <i>ukurunduense</i> Trautv. et Mey.	607
" <i>sanctae-crucis</i> Stur	584	" " var. <i>sachalinense</i>	
" <i>Schmalhauseni</i> Palib.	584	" " Nakai	607
" <i>Semenovii</i> Rgl. et Herd.	602	" <i>Van-Volkemii</i> Mast.	598
" <i>semiobciculatum</i> Pax	619	" <i>velutinum</i> Boiss.	597
" <i>sibiricum</i> Heer	584	" " var. <i>glabrescens</i> Boiss.	
" <i>Sieboldianum</i> var <i>mandschuricum</i>		" " et Buhse	598
" " Maxim.	608	" " var. <i>longifolia</i> Bornm.	598
" <i>Sosnovskyi</i> Doluch.	614	" " " <i>obtusifolia</i> Freyn et	
" <i>spicatum</i> Lam.	608	" " Sint.	598
" " Rgl.	607	" " " <i>Van-Volkemii</i>	
" " var. <i>ukurunduense</i> Ma-		" " (Mast.) Pax	598
" " xim.	607	" " " <i>velutinum</i> Boiss. et	
" " " <i>ussuriense</i> Budistsch.	607	" " Buhse	598
" <i>Stevenii</i> A. Pojark.	614	" " " <i>Wolfii</i> Schwer.	598
" <i>striatum</i> Duroi	610	" <i>villicarpum</i> Lang	597
" <i>subcampestre</i> Göpp.	584	" <i>villosum</i> Borbas	599
" <i>suberosum</i> Dumort.	596	" " Presl.	599
" <i>subobtusum</i> Simonk.	599	" sp.	584
" <i>sutchuense</i> Fr.	617	<i>Aceraceae</i> Lindl.	580
" <i>talyschense</i> Radde-Fom.	615	<i>Acetosellae</i> (Reiche) R. Knuth, sect.	79
" " var. <i>Sosnovskii</i> f. <i>den-</i>		<i>Achaenococcum</i> Vved., sect.	225
" " <i>tata</i> Radde-Fom.	615	<i>Achillaeophyllum</i> Vved., subgen.	75
" <i>tataricum</i> L.	603	<i>Acidothon ramiflorus</i> O. Ktze.	283
" " ssp. <i>Ginnala</i> var. <i>ginnala</i>		<i>Acrochordonocarpus</i> Prokh., subgenus	348
" " Wesmael	602	<i>Adenolinum</i> (Rehb.) Planch., sect.	103
" " " var. <i>Semen-</i>		<i>Adenolinum austriacum</i> Rehb.	123
" " <i>nowii</i> Wesmael	603	" <i>perenne</i> Rehb.	116
" " ssp. <i>Semenovii</i> Pax	603	" <i>squamulosum</i> Rehb.	123
" " var. <i>ginnala</i> Maxim.	602	<i>Aegle sepiaria</i> DC.	234
" " " <i>laciniatum</i> Rgl.	602	<i>Aesculiphyllum minus</i> Nath.	622
" " " <i>Semenovii</i> Rgl.	602	<i>Aesculus</i> L.	622
" " forma <i>cuspidatum</i> Pax	604	" <i>glabra</i> Willd.	623
" " <i>decalvens</i> Bl.	604	" <i>hippocastanum</i> L.	622
" " " <i>genuinum</i> Rac.	604	" <i>pavia</i> L.	623
" " <i>hebecarpum</i> Bl.	604	" sp.	622
" " " <i>oblongifolium</i> Lac.	604		

Ailanthus Desf.	241	Andrachne <i>fruticulosa</i> Boiss.	277, 278
" <i>altissima</i> (Mill.) Swingle	242	" <i>fruticulosa</i> Schischk.	277
" " var. <i>erythrocarpa</i>		" <i>hapladena</i> Pazij	281, 282
" " " Rehd.	243	" <i>maroccana</i> Ball.	271
" <i>Confucii</i> Ung.	242	" <i>minuifolia</i> Pojark.	277
" <i>glandulosa</i> Desf.	242	" <i>pulvinata</i> Pojark.	278
" <i>peregrina</i> Barkley	242	" <i>pusilla</i> Pojark.	278, 733
Alaternus DC., sect.	652	" <i>pygmaea</i> Koss.	279
Albania <i>peregrina</i> Buc'hoz	242	" <i>ramosa</i> Pojark.	272
Alcarites Forst.	303	" <i>reflexa</i> Stapf	277
" <i>cordata</i> Müll.	303	" <i>rotundifolia</i> C. A. M.	272
" " (Thunb.) R. Br.	304	" <i>rupestris</i> Pazij	281, 282
" <i>Fordii</i> Hemsl.	303	" <i>somalensis</i> Pax	271
Ampelopsis L. p. p.	707	" <i>stenophylla</i> Koss.	279
Ampelopsis Mchx.	704	" <i>Stocksii</i> Pojark.	272
" <i>aegiophylla</i> Planch.	705	" <i>suffruticosa</i> Boiss.	277
" <i>brevipedunculata</i> (Maxim.)		" <i>telephioides</i> L.	272
" " Trautv.	705	" " <i>α. genuina</i> Müll.	272
" " var. <i>Maxi-</i>		" " <i>γ. rotundifolia</i>	
" <i>moviczi</i> Rehd.	706	" " Müll.	272
" <i>cordata</i> Mchx.	705	" <i>virga-tenuis</i> Nevski	274
" <i>hederacea</i> DC.	709	" <i>Vuedenskyi</i> Pazij	272, 274
" " var. <i>dumetorum</i>		Andrachninae Pax, subtribus	268
" " Focke	709	Anisophyllum Boiss., sect.	482
" <i>heterophylla</i> (Thunb.) Sieb.		Anisophyllum Haw.	482
" " et Zucc.	706	Aquifoliaceae DC.	539
" " var. <i>amurensis</i>		Aquilegia <i>Fouriei</i> Liv.	229
" " Planch.	705	Arachne Neck.	269
" <i>humilifolia</i> Bge.	706	" <i>colchica</i> (Fisch et Mey.) Po	
" <i>inserta</i> A. Kern.	709	" " jark	269
" <i>japonica</i> (Thunb.) Makino	706	Arguta Rehd., sect.	618
" <i>napaeformis</i> Carr.	706	Asiaticae Chod., subsect.	250
" <i>quinquefolia</i> Mchx.	709	Atriplicifolia M. Pop., grex	189
" " var. <i>vitacea</i>		Aurantioideae Engler, subfam.	233
" " Knerr.	709	Balsamina <i>hortensis</i> Desf.	633
" <i>serjanaefolia</i> Bge.	706	Baisaminaceae S. F. Gray	624
" <i>tricuspidata</i> Sieb. et Zucc.	708	Barbata Boiss., sect.	65
" <i>tuberosa</i> Carr.	706	Batrachia Koch, sect.	14
" <i>vitifolia</i> (Boiss.) Planch.	705	Berchemia <i>multinervis</i> A. Br.	635
" sp.	704	Biebersteinia Steph.	74
Anacardiaceae Lindl.	518	" <i>ambigua</i> J. et Sp.	75
Anacardium	518	" <i>Aucheri</i> J. et Sp.	75
" cf. <i>occidentale uniradiatum</i> Felix	518	" <i>brachypetala</i> J. et Sp.	75
Anatropa Ehrenb.	151	" <i>Emodi</i> J. et Sp.	75
" <i>tenella</i> Ehrenb.	151	" <i>leiosepala</i> J. et Sp.	75
Andrachne L.	269	" <i>multifida</i> DC.	75
" <i>afghanica</i> Pojark.	271	" <i>odora</i> Steph.	74
" <i>asperula</i> Nevski	272, 273	Biebersteinieae (Endl.) Boiss., tribus	73
" <i>Buschiana</i> Pojark.	277	Brachycentron Warb., sect.	625
" <i>colchica</i> F. et M.	269	Bumalda Thunb.	578
" <i>cretica</i> Pojark.	271	Buxaceae Dumort.	503
" <i>Fredtschenkoi</i> Koss.	281	Buxella V. Tiegh., sect.	505
" <i>filiformis</i> Pojark.	280		

Buxus L.	504	Callitriche polym. f. aquatilis Soo	501
„ <i>angustifolia</i> Mill.	510	„ „ „ <i>heterophylla</i>	Sokol. 501
„ <i>arborescens</i> Güldenst.	509	„ „ „ <i>limicola</i> Soo	501
„ <i>arborescens</i> Mill.	510	„ „ „ <i>pseudofluitans</i>	Soo 501
„ <i>colchica</i> Pojark.	505	„ „ „ <i>terricola</i> Soo	501
„ <i>hyrcana</i> Pojark.	509	„ <i>stagnalis</i> Ldb.	498
„ <i>myrtifolia</i> Lam.	510	„ <i>stagnalis</i> Scop.	501
„ <i>sempervirens</i> M. B.	505	„ <i>subanceps</i> V. Petr.	501
„ <i>sempervirens</i> L.	509	„ „ <i>f. heterophylla</i> V.	Petr. 501
„ „ <i>f. angustifolia</i> Loud.	510	„ „ „ <i>submersa</i> V.	Petr. 501
„ „ „ <i>arborescens</i> L.	510	„ „ „ <i>terrestris</i> V.	Petr. 501
„ „ „ <i>argentea</i> Loud.	510	„ <i>verna</i> Grossh.	498
„ „ „ <i>aureo-marginata</i>	Loud. 510	„ „ <i>Hultén</i>	501
„ „ „ <i>myrtifolia</i> Loud.	510	„ „ <i>Kom.</i>	497
„ <i>sempervirens f. pendula nummula-</i>	<i>riifolia hort.</i> 510	„ <i>verna</i> L.	496
„ „ „ <i>rosmarinifolia</i> Ba-	ill. 510	„ „ <i>ssp. elegans</i> Sokol.	497
„ „ „ <i>rotundifolia</i> Baill.	510	„ „ <i>α. stagnalis</i> Schmalh.	498
„ „ „ <i>suffruticosa</i> L.	510	„ „ <i>δ. hamulata</i> Schmalh.	498
„ <i>sempervirens</i> L.	505	„ „ <i>v. vernalis</i> Schmalh.	496
„ <i>sempervirens</i> C. A. M.	509	„ „ <i>f. angustifolia</i> Hoppe	497
„ <i>suffruticosa</i> Mill.	510	„ „ <i>f. caespitosa</i> Schultz	497
Callitrichaceae Lindl.	495	„ „ <i>fontana</i> Kütz.	497
Callitriche L.	495	„ „ „ <i>minima</i> Hoppe	497
„ <i>angustifolia</i> Gilib.	502	„ „ „ <i>stellata</i> Hoppe	497
„ <i>autumnalis</i> L.	502	„ <i>vernalis</i> Korsh.	497
„ <i>elegans</i> V. Petr.	497	„ „ Kütz.	497
„ „ <i>f. caespitosa</i> V. Petr.	497	„ „ <i>Rgl. et Tiling</i>	501
„ „ „ <i>heterophylla</i> V.	Petr. 497	„ <i>virens</i> Goldb.	502
„ „ „ <i>spathulifolia</i> V. Petr.	497	Camirium Rumph.	303
„ „ „ <i>stellata</i> V. Petr.	498	Caprinae DC., sect.	81
„ „ „ <i>submersa</i> V. Petr.	497	Carunculares Boiss., subsect.	384, 389
„ „ „ <i>terrestris</i> V. Petr.	497	Cascara Grub., sect.	643
„ <i>fallax</i> V. Petr.	498	Catharticoformes Grub., subsect.	664
„ <i>hamulata</i> Ldb.	502	Cathartolinum (Rchb.) Planch., sect.	127
„ <i>hermaphroditica</i> L.	502	Cathartolinum corymbulosum Rehb.	128
„ <i>Kützingii</i> Rupr.	498	„ „ <i>gallicum</i> Rehb.	129
„ <i>latifolia</i> Gilib.	496	„ „ <i>pratense</i> Rehb.	127
„ <i>pallens</i> Goldb.	496	Celastraceae Lindl.	546
„ <i>palustris</i> L.	496	Celastroideae Lois., subfam.	547
„ „ <i>ssp. caespitosa</i> Kryl.	497	Celastrophyllum subundulatum Krysh.	574
„ „ „ <i>stagnalis</i> Kryl.	501	Celastrus L.	574
„ „ „ <i>verna</i> Schinz et	Thell. 497	„ <i>atriculata</i> Thunb.	575
„ „ „ <i>β. bifida</i> L.	502	„ <i>borealis</i> Heer	574
„ <i>palustris</i> Rupr. var. <i>stagna-</i>	<i>lem</i> Rupr. 498	„ <i>cf. elaeina</i> Ung.	574
„ <i>pedunculata</i> DC.	502	„ <i>flagellaris</i> Rupr.	576
„ <i>polymorpha</i> Loennr.	498	„ <i>lucida</i> var. <i>fossilis</i> Pim.	574
		„ <i>Nathorstii</i> Baik.	574
		„ <i>orbiculata</i> L.	575

Celastrus <i>Persei</i> Ung.	574	Cissus <i>insularis</i> Heer	707
„ <i>strigillosus</i> Nakai	576	„ <i>kolymensis</i> Krysh.	707
„ <i>tauriensis</i> Ward.	574	„ <i>quinquefolia</i> Sims	709
Cernuae R. Kanth, sect.	81	„ <i>spectabilis</i> Heer	707
Cervispina DC., sect.	656	„ <i>vitifolia</i> Boiss.	705
Chamaesyce S. F. Gray	482	„ sp.	707
Chamaesyce (S. F. Gray)? L. C. Wheeler, subgenus	482	Citrus L.	234
Ghamaesyce <i>anisopetala</i> Prokh.	492	„ <i>aurantium</i> L.	238
„ <i>canescens</i> (L.) Prokh.	491	„ „ var. <i>japonica</i> Hook.	241
„ <i>Forskali</i> (J. Gay) Prokh.	493	„ <i>deliciosa</i> Ten.	238
„ <i>humifusa</i> (Willd.) Prokh.	487	„ <i>japonica</i> Thunb.	241
„ <i>indica</i> (Lam.) Prokh.	486	„ <i>limetta</i> Risso	238
„ <i>maculata</i> (L.) Small	494	„ <i>limon</i> Burm.	237
„ <i>nutans</i> (Lagasca) Small	485	„ <i>limonum</i> Risso	237
„ <i>peplis</i> (L.) Prokh.	486	„ <i>medica</i> L.	238
„ <i>turcomanica</i> (Boiss.) Prokh.	492	„ „ β . <i>Limon</i> L.	237
„ <i>vulgaris</i> Prokh.	488	„ <i>nobilis</i> var. <i>unschui</i> Swing.	237
Cheitrolepidium Boiss., sect.	480	„ <i>paradisi</i> Mactad.	238
Chrozophora Neck.	288	„ <i>sinensis</i> Osbeck	238
„ <i>cordifolia</i> Pajiz	291	„ „ \times <i>Poncirus trifoliata</i>	234
„ <i>gracilis</i> Boiss.	289	„ „ „ \times <i>For-</i> <i>tunella</i> sp.	234
„ <i>gracilis</i> Fisch. et Mey.	290	„ <i>trifoliata</i> L.	234
„ <i>hierosolymitana</i> Spreng.	291	„ <i>triptera</i> Desf.	234
„ <i>integrifolia</i> Bge.	295	„ <i>unshiu</i> Hort.	237
„ <i>obliqua</i> (Vahl.) A. Juss.	291, 292	„ <i>unshiu</i> Marc.	237
„ <i>pannosa</i> Pajiz	290	Collina Knuth, subsect.	42
„ <i>sabulosa</i> Kar. et Kir.	289	Columbina Koch, sect.	12
„ „ var. <i>nuda</i> Pojark.	290	Coniocarpae Prokh., subsect.	392
„ <i>sabulosa</i> Pax et Hoffm.	290	Coniocarpus Prokh., sect.	392
„ <i>Sieberi</i> Presl.	291	Corniculatae (Reiche) Knuth, sect.	77
„ <i>tinctoria</i> (L.) A. Juss.	290	Cotinus Adans.	526
„ „ var. <i>genuina</i> Müll.	290	„ <i>americanus</i> Nutt.	518, 527
„ „ α . <i>verbascifolia</i> Müll.	295	„ <i>elliptica</i> Baik.	526
„ „ β . <i>hierosolymita-</i> <i>na</i> Müll.	291	„ <i>coggygia</i> Mill.	526
„ <i>tinctoria</i> L. db.	291	„ <i>coggygia</i> Scop.	526
„ <i>verbascifolia</i> Baill.	291	„ „ var. <i>cinerea</i> Engl.	527
„ „ A. Juss.	291, 292	„ „ „ <i>laevis</i> Engl.	527
Chrosophorinae Pax, subtribus	288	„ „ „ <i>pubescens</i> Engl.	527
Chylogala Prokh., sect.	384, 388	„ „ „ <i>purpurea</i> Rehd.	527
Chylogala Prokh., subgenus	384	„ „ „ <i>velutina</i> Engl.	527
Cissites <i>inaequantibus</i> Jarm.	707	„ <i>coggygia</i> Scop.	526
„ <i>Kryshstofovichianus</i> Jarm.	707	„ <i>ucrainica</i> Baik.	526
„ <i>prodrum</i> Krysh.	707	Croton <i>argenteum</i> Forsk.	292
„ <i>uraensis</i> Krysh.	707	„ <i>obliquum</i> Vahl.	292
Cissus <i>aegirophylla</i> Bge.	705	„ <i>oblongifolium</i> Sieber	291
„ <i>ampelopsis</i> Pers.	705	„ <i>patulus</i> Lagasca	292
„ <i>atlantica</i> Ett.	707	„ <i>tinctorius</i> L.	290
„ <i>brevipedunculata</i> Maxim.	705	„ <i>verbascifolium</i> Willd.	292
„ <i>Cockerellii</i> Krysh. et Baik.	707	„ <i>villosum</i> Sibth. et Sm.	292
„ <i>humulifolia</i> Rgl.	706	Crotoneae Pax, tribus	288
		Crotonoideae Pax, subfam.	288
		Crotonopsidae Boiss., subsect.	476

<i>Ctenadena</i> Prokh.	476	<i>Empetrum</i> androgynum V. Vassil. . . .	515
" <i>lanata</i> Prokh.	476	" " var. caucasicum	
<i>Cupania longipes</i> Heer	624	V. Vassil.	516
<i>Cymatospermum</i> Prokh., sect. 383, 456, 459, 743		" arcticum V. Vassil.	516
<i>Cystidospermum</i> Prokh.	480	" <i>asiaticum</i> Nakai	513, 515
<i>Cystidospermum</i> Prokh., subgen.	480	" <i>atropurpureum</i> Fern. et Wieg.	517
" <i>cheirolepis</i> (Fisch. et		" <i>Eamesii</i> Fern. et Wieg. . . .	517
Mey.) Prokh.	481	" hermaphroditum (Lge.) Hage-	
		rup	515
<i>Dasylinum</i> Planch., sect.	140	" Kardakovii V. Vassil.	517
<i>Datisca hirta</i> L.	530	" kurilense V. Vassil. . . .	514, 744
<i>Decussatae</i> Boiss., subsect.	479	" <i>nigrum</i> auct.	513, 514, 515
<i>Dematra</i> Rafin.	476	" <i>nigrum</i> L.	512
<i>Dematra</i> (Rafin.) Prokh., sect.	476	" " var. <i>asiaticum</i> Na-	
<i>Dematra sericea</i> Raf.	476	kai	513, 515
<i>Densiusculae</i> Prokh., subsect.	475, 743	" " " <i>japonicum</i> f. <i>albi-</i>	
<i>Dichrolinum</i> Planch., sect.	125	<i>carpum</i> (Sugawa-	
<i>Dictamnus</i> L.	227	ra) Honda	513
" <i>albus</i> auct.	227, 229, 230, 231	" " f. <i>hermaphroditum</i>	
" " L.	231	lge.	515
" " ssp. <i>caucasicus</i> Wint.	231	" " " <i>japonicum</i> R.	
" " " <i>dasycarpus</i> Trautv.	229	Good	513, 515
" " " <i>gymnostylis</i> Wint.	231	" " " <i>leucocarpum</i>	
" " " <i>turkestanicus</i>		Aschers. et Magn.	513
Wint.	230	" <i>polare</i> V. Vassil.	515
" <i>angustifolius</i> G. Don	230	" <i>procumbens</i> Gilib.	512
" <i>caucasicus</i> Fisch.	231	" <i>pubescens</i> V. Vassil.	513
" <i>dasycarpus</i> Turcz.	229	" <i>purpureum</i> Raf.	517
" <i>gymnostylis</i> Stev.	231	" <i>sibiricum</i> V. Vassil.	513
" <i>fraxinella</i> auct.	229, 230, 231	" " var. <i>asiaticum</i> Na-	
" " var. <i>caucasica</i>		kai	513, 514
Fisch. et Mey.	231	" <i>sibiricum</i> f. <i>genuina</i> V. Vas-	
" " lus. a. Ldb.	231	sil.	513
" " " b. Ldb.	230	" " " <i>pubescens</i> V. Vas-	
" " " c. Ldb.	229	sil.	513
" <i>himalayanus</i> Royle	230	" " " <i>stenopetalum</i> V.	
" <i>tadshikorum</i> Vved.	229	Vassil.	513
" <i>turkestanicus</i> var. <i>buchari-</i>		" <i>stenopetalum</i> V. Vassil. . . .	513
cus Wint.	229	" <i>subholarcticum</i> V. Vassil. . .	515
<i>Dimorpha</i> Alef.	111	<i>Epurga</i> Fourr.	479
<i>Dipteronia</i> Oliv.	580	<i>Epurga</i> Prokh., sect.	479
<i>Diitrita</i> Rafin.	482	<i>Epurga</i> Prokh., subgenus	479
<i>Divaricata</i> Rouy, sect.	56	<i>Erodium</i> L'Hér.	63
<i>Dryandra oleifera</i> Wall.	308	" <i>absinthoides</i> Boiss.	67
<i>Dumosa</i> M. Pop., §	188	" " var. <i>armena</i> Tra-	
" " <i>grex</i>	188	utv.	68
<i>Dumosa</i> (M. Pop.) Boriss., subgen.	188	" " " <i>fumarioides</i>	
		Boiss.	67
<i>Earinocissus</i> Graebn., sect.	708	" <i>anthemidifolium</i> M. B.	68
<i>Elaeococca verrucosa</i> Juss.	303	" <i>armenum</i> Voron.	68
<i>Empetraceae</i> Lindl.	511	" <i>Beketovii</i> Schmalh.	67
<i>Empetrum</i> L.	511	" <i>bryoniaefolium</i> auct.	65
" <i>albicarpha</i> Sugawara	513, 514	" <i>chium</i> (Burm. f.) Willd. . . .	69, 70

<i>Erodium ciconium</i> (L.) Ait.	71	<i>Euonymus fibrilliferus</i> Fisch. et Mey. . .	553
" <i>clortarium</i> (L.) L'Hér.	71	" <i>floribundus</i> Stev.	553
" <i>fumarioides</i> Schmalh.	66	" <i>Hamiltoniana</i> auct.	555
" <i>fumarioides</i> Stev.	67	" " var. <i>Sieboldiana</i>	
" <i>guttatum</i> Ldb.	64	" Kom.	556
" <i>Hoeftianum</i> C. A. M.	70	" <i>hians</i> Koehne	556
" <i>Hohenackeri</i> auct.	65	" <i>japonica</i> L.	552
" " Ldb.	69	" <i>Koopmanni</i> Lauche	565
" <i>Jacquinianum</i> auct.	71	" <i>latifolia</i> Mill.	569
" <i>laciniatum</i> auct.	70	" " var. <i>sachalinensis</i> F.	
" <i>Litvinovii</i> Voron.	65	" Schmidt	571
" <i>malacoides</i> Voron.	69, 70	" <i>latifolia</i> Scop.	550
" <i>malacoides</i> (L.) Willd.	69	" <i>leiophloea</i> Stev.	572
" <i>multicaule</i> Link	68	" <i>Maackii</i> Rupr.	555
" <i>Neilreichii</i> Janka	70	" <i>macroptera</i> Rupr.	573
" <i>obtusilobum</i> Kar.	64	" <i>media</i> Kit.	553
" <i>oxyrrynchum</i> M. B.	64	" <i>nana</i> M. B.	561
" <i>pulchellum</i> Karel.	71	" " var. <i>Koopmanni</i> Dippel	565
" <i>pulverulentum</i> auct.	70	" " " <i>turkestanica</i> Krysh.	565
" <i>ruthenicum</i> M. B.	68	" <i>ovalifolia</i> Bors.	550
" <i>schemachense</i> Grossh.	67	" <i>pauciflora</i> Maxim.	560
" <i>Semenovii</i> Rgl.	70	" <i>Proserpinae</i> Ett.	550
" <i>serotinum</i> Stev.	68	" <i>sachalinensis</i> auct.	570
" " var. <i>plurijugum</i> Bo-		" <i>sachalinensis</i> (F. Schmidt)	
" iss.	70	" Maxim.	570, 571, 572
" <i>Stephanianum</i> Willd.	65	" <i>sacrosancta</i> Koidz.	557
" <i>Stevenii</i> M. B.	66	" <i>Semenovii</i> Rgl. et Herd.	559
" <i>strigosum</i> Karel.	70	" <i>sempervirens</i> Rupr.	572
" <i>tataricum</i> Willd.	66	" <i>Sieboldiana</i> Blume	556
" <i>tibetanum</i> Edgew.	65	" <i>striata</i> (Thunb.) Loes.	558
" <i>tibetanum</i> O. Fedtsch.	65	" <i>ussuriensis</i> Maxim.	573
<i>Esula</i> Haw.	309	" <i>velutina</i> (C. A. M.) Fisch.	
<i>Esula</i> Prokh., sect.	413	" et Mey.	557
<i>Esulae</i> Prokh., subsect.	413	" <i>verrucosa</i> Scop.	559
<i>Eubiebersteinia</i> Vved., subgenus	74	" " var. <i>paciflora</i> Rgl.	560
<i>Eubuxus</i> Bail., sect.	534	" <i>vulgaris</i> Mill.	553
<i>Eucallitriche</i> Hegelm., sect.	496	" <i>yesoensis</i> Koidz.	568
<i>Eucelastreae</i> Lois., tribus	573	<i>Eupalustria</i> Knuth, subsect.	40
<i>Eufabago</i> M. Pop., sect.	159	<i>Eu-perennia</i> Juz., subgenus	116
<i>Eufrangula</i> Grub., sect.	642	<i>Euphorbia</i> L.	304
<i>Euonymae</i> Lois., tribus	547	" <i>abchastica</i> Woron.	349
<i>Euonymus</i> L.	548	" <i>Abolini</i> Eug. Kor.	379
" <i>alata</i> auct.	557	" <i>acuminata</i> Lam.	465
" <i>alata</i> var. <i>pubescens</i> Maxim.	557	" <i>aegyptiaca</i> Boiss.	493
" " (Thunb.) Rupr.	558	" <i>agraria</i> M. B.	430
" <i>caucasica</i> Lodd.	561	" <i>alaica</i> Prokh.	388
" <i>coreana</i> Lévl.	555	" <i>alata</i> Boiss.	373
" <i>erosidens</i> Prokh.	570	" <i>aleppica</i> L.	460
" <i>europaea</i> L.	553	" <i>alpina</i> C. A. M.	370
" " var. <i>Hamiltoniana</i> Ma-		" <i>altaica</i> C. A. M.	381
" xtm.	555	" <i>ambigua</i> Waldst. et Kit.	365
" " <i>Semenovii</i> Rgl.	559	" <i>amplexicaulis</i> Ldb.	377
" " <i>velutinus</i> C. A. M.	557	" <i>amygdaloides</i> L.	456

<i>Euphorbia amygdaloides</i> β. <i>oblongifolia</i>	
C. Koch	455
<i>andrachnoides</i> Schrenk	418
<i>angulata</i> Jacq.	381, 453
<i>anisopetala</i> Prokh.	492
<i>antiquorum</i> L.	309
<i>aristata</i> Schmalh.	361
<i>armena</i> Prokh.	411, 741
<i>artvinensis</i> Bornm. et Woron.	352
<i>arvalis</i> Boiss. et Heldr.	472
<i>azerbajdzhanica</i> Bordz.	470
<i>aspera</i> M. B.	349
<i>astrachanica</i> C. A. M.	440
<i>Aucheri</i> Boiss.	456
<i>aulacosperma</i> Boiss.	464
<i>austriaca</i> Kern.	358
<i>biglandulosa</i> Desf.	405
<i>blepharophylla</i> C. A. M.	345
<i>Boissieriana</i> (Woron.) Prokh.	445
<i>bonnophila</i> var. <i>Aucheri</i> Boiss.	456
<i>Borodini</i> Sambuk	427
<i>Borszczowii</i> Prokh.	425, 742
<i>buchtormensis</i> C. A. M.	371
" var. <i>alata</i> Rgl.	373
<i>Buhsei</i> Boiss.	419
<i>Bungei</i> Boiss.	386
<i>Buschiana</i> Grossh.	413
<i>caesia</i> Kar. et Kir.	440, 448
<i>canescens</i> L.	491
<i>carniolica</i> Jacq.	365
<i>carnea</i> Paulsen	472
<i>carpatica</i> Woloczcz.	357
<i>Chamaesyce</i> auct.	487
<i>chamaesyce</i> L.	488
<i>chamaesyce</i> var. <i>canescens</i> Steud.	491
<i>cheirolepis</i> Fisch. et Mey.	481
" var. <i>longifolia</i>	481
<i>chimaera</i> Lipsky	426
<i>cilicica</i> Boiss.	412
<i>condensata</i> Fisch.	460
<i>condylocarpa</i> M. B.	377
<i>coniosperma</i> Boiss. et Buhse	369
<i>consanguinea</i> auct.	467
<i>consanguinea</i> Schrenk	471
<i>craspedia</i> Boiss.	412
<i>cyparissias</i> L.	439
<i>cyrtophylla</i> Prokh.	441
<i>dalmatica</i> Vis.	461
<i>damascena</i> Boiss.	400
<i>deltobracteata</i> Prokh.	457
<i>dendroides</i> L.	309
<i>densa</i> Schrenk	473
<i>densiuscula</i> M. Pop.	475

<i>Euphorbia denticulata</i> Lam.	412
" <i>depressa</i> Torrey	494
" <i>desertorum</i> Weinm.	360, 422
" <i>discolor</i> Bertol.	423
" <i>discolor</i> Ldb.	423
" <i>dulcis</i> L.	379, 452
" var. <i>incompta</i> Cesati	380
" " <i>lasiocarpa</i> Neilreich	380
" <i>epithymoides</i> auct.	364
" <i>eriophora</i> Boiss.	382
" <i>eriophylla</i> Kar. et Kir.	448
" <i>esula</i> L.	419, 421
" var. <i>caesia</i> Boiss.	440
" " <i>cyparissoides</i> Boiss.	448
" " <i>genuina</i> auct.	423
" " β. <i>gracilis</i> Kryl.	421
" <i>Eugeniae</i> Prokh.	356, 735
" <i>exigua</i> L.	460
" <i>falcata</i> L. var. <i>minor</i> Koch	465
" <i>ferganensis</i> B. Fedtsch.	346
" <i>firma</i> Ldb.	396
" <i>Forskalii</i> J. Gay.	493
" <i>Francheti</i> B. Fedtsch.	467
" <i>Fuhsii</i> Bornm. et. Sint.	398
" <i>galilaea</i> Boiss.	465
" <i>Gerardiana</i> Jacq.	395
" " f. <i>arenaria</i> Litw.	396, 397
" " " <i>rupestris</i> Litw.	396, 397
" <i>glaberrima</i> C. Koch	454
" <i>glareosa</i> auct.	403
" <i>glareosa</i> Pall.	402
" var. <i>elatior</i> M. B.	401
" " <i>minor</i> Boiss.	402
" <i>glomerulans</i> Prokh.	429
" <i>Gmelinii</i> Steud.	422
" <i>Goidei</i> Prokh.	404, 738
" <i>gracilis</i> auct.	421
" <i>graeca</i> Boiss. et Sprun.	461, 383
" <i>Grossheimii</i> Prokh.	391
" <i>guntensis</i> Prokh.	442
" <i>helioscopia</i> L.	383
" <i>herniariifolia</i> Boiss.	414
" <i>humifusa</i> Willd.	487
" var. <i>glabra</i>	487
" " <i>pilosa</i>	487
" <i>humilis</i> C. A. M.	397
" <i>hypericifolia</i> auct.	485
" <i>hyrcana</i> Grossh.	463
" <i>iberica</i> auct.	436
" <i>iberica</i> Boiss.	435
" <i>incompta</i> Cesati	379
" <i>indriensis</i> Less.	468
" <i>indica</i> Lam.	486

<i>Euphorbia irgisensis</i> Litw.	417	<i>Euphorbia</i> nic. β . <i>minor</i> Ldb.	392
" <i>ispahanica</i> Boiss.	390	" <i>Normanni</i> Schmalh.	466
" <i>iteophylla</i> Boiss.	454	" <i>notadenia</i> Boiss.	352
" <i>jaxartica</i> Prokh.	446	" <i>nuda</i> auct.	362
" <i>Kaleniczenkii</i> Czern.	422	" <i>nutans</i> Lagasca	485, 494
" <i>kanaorica</i> Boiss.	459	" <i>oblongifolia</i> C. Koch	455
" <i>Karoi</i> Freyn	424	" <i>obscura</i> Loisel.	465
" <i>kaschgarica</i> Rgl.	373	" <i>orientalis</i> L.	352
" <i>Komaroviana</i> Prokh.	343, 734	" <i>pachyrrhiza</i> Kar. et Kir.	378
" <i>kopetdagensis</i> E. Kor.	419	" <i>Pallasii</i> auct.	342
" <i>kopetdaghi</i> Prokh.	398	" <i>Pallasii</i> Turcz.	343
" <i>Korovini</i> Pavl.	397, 398	" <i>palustris</i> L.	355
" <i>Kudrjaschevii</i> (Pazij) Prokh.	352	" " var. β . C. A. M.	362
" <i>lamprocarpa</i> Prokh.	362	" <i>pamirica</i> Prokh.	438, 443
" <i>lanata</i> Sieber	476	" <i>pannonica</i> auct.	401
" <i>lasiocarpa</i> C. Koch	382	" <i>paralias</i> L.	391
" <i>lathyris</i> L.	479	" <i>parvula</i> C. Koch	472
" <i>latifolia</i> auct.	427	" <i>pectinata</i> Albofi	412, 413
" <i>latifolia</i> C. A. M.	426	" <i>pectinata</i> auct.	408
" <i>latifolia</i> Ldb.	435	" <i>peplis</i> L.	486
" <i>Ledebourii</i> Boiss.	462	" <i>peplus</i> L.	463
" <i>leptocaula</i> Boiss.	443	" <i>petrophila</i> C. A. M.	392
" " var. <i>Bogdani</i> Litw.	436	" <i>pilosa</i> auct.	358, 359, 360, 363
" " <i>praecox</i> Boiss.	440	" <i>pilosa</i> L.	363
" <i>leptocladula</i> auct.	420	" <i>platyphylla</i> L.	367
" <i>Lipskyi</i> Prokh.	347	" <i>poecilophylla</i> Prokh.	428
" <i>lucida</i> Waldst. et Kit.	434	" <i>polychroma</i> Kern.	364
" <i>lucorum</i> Rupr.	374	" <i>polygonifolia</i> Jacq.	494
" <i>lutescens</i> C. A. M.	363	" <i>polygonisperma</i> Gren. et	
" <i>Maackii</i> Meinsh.	423	Godr.	487
" <i>macrocarpa</i> Boiss. et Buhse	350	" <i>polytimetica</i> Prokh.	458
" <i>macroceras</i> Fisch. et Mey.	455	" <i>pontica</i> Prokh.	740
" <i>macroclada</i> Boiss.	400	" <i>Postii</i> Boiss.	481
" <i>macrorrhiza</i> C. A. M.	371	" <i>praecox</i> Fisch.	440
" <i>maculata</i> L.	494, 485	" <i>Preslii</i> Guss.	485
" <i>Maleevi</i> Tamamsch.	402	" <i>procera</i> auct.	360
" <i>mandshurica</i> Maxim.	433	" " M. B.	359
" <i>Mariae</i> Tamamsch.	391	" " var. <i>leiocarpa</i> Ldb.	360
" <i>Marschalliana</i> auct.	406	" <i>Prokhanovii</i> M. Pop.	340
" <i>Marschalliana</i> Boiss.	410	" <i>prorepens</i> M. Pop.	458
" <i>megalantha</i> auct.	390	" <i>pseudagraria</i> P. Smirn.	436
" <i>micans</i> Scheele	453	" <i>pseudochamaesyce</i> Fisch. et	
" <i>micrantha</i> M. B.	366	Mey.	478
" <i>microcarpa</i> Prokh.	420	" <i>pseudograeca</i> Grossh.	465
" <i>microsperma</i> Boiss.	363	" <i>pubescens</i> Vahl	372
" <i>mongolica</i> Prokh.	342	" <i>punctata</i> auct.	472
" <i>monocyathium</i> Prokh.	338	" <i>purpurata</i> Thuill.	379
" <i>monostyla</i> Prokh.	406, 739	" <i>pygmaea</i> auct.	462
" <i>mucronulata</i> Prokh.	351	" " Fisch. et Mey.	468
" <i>muricata</i> M. B.	349	" <i>rapulum</i> Kar. et Kir.	344
" <i>myrsinites</i> auct.	410	" <i>retusa</i> auct.	461
" <i>myrsinites</i> L.	408	" <i>rigida</i> M. B.	405
" <i>nicaeensis</i> β . <i>glareosa</i> Ldb.	402	" <i>rossica</i> P. Smirn.	422

<i>Euphorbia rosularis</i> A. Theod.	339	<i>Euphorbia triodonta</i> Prokh.	469
" <i>ruderalis</i> Scheele	472	" <i>tristis</i> Bess.	419
" <i>rumicifolia</i> Boiss.	455	" <i>tshulensis</i> Prokh.	440
" <i>rupestris</i> auct.	339	" <i>turcomanica</i> Boiss.	492
" <i>rupestris</i> C. A. M.	341	" <i>Turczaninowii</i> Kar. et Kir.	472
" <i>salicifolia</i> Host	429	" <i>turkestanica</i> Franch.	467
" " β . <i>latifolia</i> Ldb.	435	" <i>turkestanica</i> Rgl.	383
" <i>sareptana</i> Beck.	425	" <i>undulata</i> M. B.	414
" " var. <i>chimera-typica</i>	426	" <i>uralensis</i> Fisch.	437
" " " <i>kimmerica</i>	426	" <i>verrucosa</i> L.	380
" Savaryi Kiss.	452	" <i>verticillata</i> Fisch.	343
" <i>saxatilis</i> auct.	392	" <i>villosa</i> Waldst. et Kit.	359
" <i>schizoceras</i> Boiss.	400	" <i>virgata</i> Waldst. et Kit.	443
" <i>schugnanica</i> B. Fedtsch.	387	" " var. <i>latifolia</i> auct.	427
" <i>sclerocyathium</i> E. Kor. et M.		" " " <i>linearis</i> Schmalh.	444
Pop. 336		" " " <i>orientalis</i> Boiss.	445, 446
" <i>scripta</i> Somm. et Lev.	348	" " " <i>uralensis</i> Ldb.	437
" <i>Seguieriana</i> Neck.	395	" <i>volgensis</i> Krysh.	403
" <i>semivillosa</i> Prokh.	360	" <i>Wittmanni</i> Boiss.	377
" <i>serawschanica</i> Rgl.	338	" <i>Woronowii</i> Grossh.	409
" " var. <i>hirta</i> Eug. Kor.	338	" <i>zhiguliensis</i> Prokh.	447
" <i>Sewerzowii</i> Herd.	433	<i>Euphorbia</i> sp.	307
" <i>Sieboldiana</i> auct.	452	<i>Euphorbiaceae</i> J. St.-Hil.	266
" <i>Sieboldiana</i> Morr. et Decne.	451	<i>Euphorbieae</i>	304
" <i>sogdiana</i> M. Pop.	399	<i>Eupolygala</i> Bennet, sect.	252
" <i>solissequa</i> Rehb.	379	<i>Eupolygalon</i> Tamamsch., subsect.	256
" <i>songarica</i> Boiss.	362	<i>Eurhamnus</i> Boiss., sect.	653
" <i>soongarica</i> auct.	561, 362	<i>Eusylvatica</i> Knuth, subsect.	21
" <i>sororia</i> auct.	470	<i>Eutoxicodendron</i> C. K. Schn., sect.	532
" <i>sororia</i> Schrenk	470	<i>Euvtis</i> Planch., sect.	678
" <i>spindens</i> Bornm.	407	<i>Euzygophyllum</i> M. Pop., subgenus 184, 188 189	
" <i>spongiosa</i> Ldb.	479		
" <i>squamosa</i> Willd.	349		
" <i>stepposa</i> Zoz	401, 738	<i>Fabago</i> Adans.	158
" <i>stricta</i> L.	366	<i>Fabago</i> (Adans.) M. Pop., subgenus	158
" <i>subamplexicaulis</i> Kar. et Kir.	371	<i>Fabago</i> Endl., sect.	159
" <i>subcordata</i> C. A. M.	441, 448	<i>Elueggea suffruticosa</i> Baill.	283
" " var. <i>eriophylla</i>	448	<i>Flüggea</i> Willd.	284, 287
" <i>subtilis</i> Prokh.	421	" <i>leucopyrus</i> Willd.	287
" <i>subtuberculata</i> C. A. M.	368	" <i>ussuriensis</i> Pojark.	284, 734
" <i>sylvatica</i> L.	453	<i>Fortunella</i> Swing.	238
" <i>syspirensis</i> C. Koch	400	" <i>japonica</i> (Thunb.) Swing.	241
" <i>Szovitsii</i> Fisch. et Mey.	474	" <i>Margarita</i> (Lour.) Swing.	241
" <i>talastavica</i> Prokh.	379	<i>Frangula</i> Mill.	641
" <i>tanaitica</i> Paczoski	425	" <i>alnus</i> Miller	642
" <i>tauricola</i> Prokh.	358, 736	" " var. <i>abchasica</i> Pastern.	642
" <i>tenuifolia</i> auct.	443	" " <i>latifolia</i> (Dipp.) Grub.	642
" <i>thymifolia</i> Forsk.	493	" " <i>orientalis</i> Somm. et Lev.	642
" <i>tianschanica</i> Prokh.	339	" <i>grandifolia</i> (Fisch. et Mey.) Grub.	643
" <i>tibetica</i> Boiss.	385		
" <i>tinctoria</i> Boiss. et Huet	400	" <i>pentapetala</i> Gilib.	642
" <i>transoxana</i> Prokh.	350	" <i>Purshiana</i> Coop.	644
" <i>Tranzschelii</i> Prokh.	386	" <i>rupestris</i> (Scop.) Schur	644

<i>Frangula vulgaris</i> Rehb.	642	<i>Geranium</i> arm. β . <i>Albowii</i> Lipsky	18
" <i>Wulfenii</i> Rehb.	644	" <i>asiaticum</i> Serg.	30
<i>Fruticulosae</i> Pax et K. Hoffm., sect. . . .	277	" <i>asfodeloides</i> Burm.	51
<i>Galarrhoei</i> Boiss., subsect.	347	" " β . <i>hispidum</i> Boiss.	50
<i>Galarhoeus</i> Haw.	309	" <i>baicalense</i> Turcz.	27, 29
" <i>Borodini</i> Prokh.	427	" <i>batrachoides</i> β . <i>cyanostemon</i>	Rupr. 33
" <i>cyparissias</i> Smoll	439	" <i>berezovkaeanum</i> Prod.	41
" <i>densiusculiformis</i> Pazlj.	475	" <i>bifolium</i> Patrin	30
" <i>falcatus</i> Prokh.	464	" <i>bifolium</i> Turcz.	29
" <i>Gmelini</i> Prokh.	422	" <i>bohemicum</i> L.	59
" <i>helioscopius</i> (L.) Haw.	383	" <i>brotherusianum</i> Trautv.	17
" <i>Kudrjashevii</i> Pazij	352	" <i>calvum</i> Trautv.	29
" <i>lathyrus</i> Haw.	479	" <i>campestre</i> Schangin	29
" <i>leptocaulus</i> Prokh.	443	" <i>candidum</i> Kom.	44
" <i>paluster</i> (L.) Haw.	355	" <i>Charlesii</i> (Aitch. et Hemsl.)	Vved. 62
" <i>peplus</i> Prokh.	463	" <i>chium</i> Burm. f.	69
" <i>pilosus</i> Haw.	364	" <i>ciconium</i> L.	71
" <i>pseudoagrarius</i> (P. Smirn.)	Prokh. 436	" <i>cicutarium</i> L.	71
" <i>Seguierianus</i> Prokh.	396	" <i>cinereum</i> β . <i>subcaulescens</i>	Knuth 10
" <i>semivillosus</i> Prokh.	360	" <i>coeruleo-purpureum</i> Gilib. . . .	24
" <i>songaricus</i> Prokh.	361, 362	" <i>coeruleum</i> Gilib.	31
" <i>strictus</i> Haw.	366	" " Patrin	29
" <i>subcordatus</i> Prokh.	448	" <i>collinum</i> M. B.	50
" <i>subtilis</i> Prokh.	421	" <i>collinum</i> Steph.	43
" <i>undulatus</i> Prokh.	414	" " var. <i>adenotrichum</i>	(Schrenk) Briq. 43
" <i>uralensis</i> Prokh.	437	" " <i>candidum</i> (Kom.)	B. Fedtsch. 44
" <i>virgatus</i> Prokh.	444	" " <i>hirsuta</i> Trautv.	43
" <i>volgensis</i> Prokh.	403	" " <i>wakhanicum</i> Paulsen	43
" <i>zhigulensis</i> Prokh.	447	" " α . <i>glandulosum</i> Ldb. . . .	43
<i>Geblera suffruticosa</i> Fisch. et Mey. . . .	283	" " β . <i>eglandulosum</i> Ldb. . . .	43
" <i>sungarensis</i> Rupr.	283	" " γ . <i>saxatile</i> Rgl.	44
<i>Gemmata</i> Pojark., sect.	597	" " ϵ . <i>viscosum</i> Rgl.	43
<i>Geraniaceae</i> J. St. Hil.	1	" " τ . <i>alpinum</i> Rgl.	44
<i>Geraniales</i> Lindl.	1	" " 1. <i>intermedia</i> Kom.	45
<i>Geranieae</i> Benth., trib.	2	" <i>columbinum</i> L.	12
<i>Geranium</i> L.	2	" <i>cristatum</i> Stev.	49
" <i>acrocarphum</i> Ldb.	57, 59	" <i>dahuricum</i> DC.	11
" <i>affine</i> Ldb.	33	" <i>depilatum</i> (Somm. et Lev.)	Grossh. 52
" <i>alatavicum</i> M. Pop.	44	" <i>dissectum</i> L.	14
" <i>albanum</i> M. B.	49	" <i>divaricatum</i> Ehrh.	57
" <i>albiflorum</i> Korsh.	24	" <i>elatum</i> Knuth	24
" <i>albiflorum</i> Ldb.	27	" " (Maxim.) Knuth	23
" " f. <i>lilacinum</i> Kryl.	28	" <i>erectum</i> Trautv.	30
" <i>alpestre</i> Schur	27	" <i>erianthum</i> DC.	23, 24
" <i>amethystinum</i> Ldb.	18	" " var. <i>elatum</i> Maxim. . . .	23
" <i>angustifolium</i> Gilib.	14	" " f. <i>communis</i> Kom. . . .	24
" " var. <i>albidum</i> O.	Ktze. 14	" <i>eriosomon</i> Fisch.	22, 24
" <i>argenteum</i> Luce	55		
" <i>armenum</i> Boiss.	18		
" " var.? Alb.	18		

<i>Geranium eriostemon</i> var. <i>hypoleucum</i>		<i>Geranium pallens</i> M. B.	50
" " β . <i>orientale</i> Maxim.	23	" <i>palustre</i> L.	40
" " Turcz.	23	" " β . <i>minus</i> Bess. . . .	41
" <i>eriosomum</i> Rgl.	22	" <i>phaeum</i> L.	39
" <i>europaeum</i> M. Pop.	59	" <i>platypetalum</i> F. et M. . . .	20
" <i>ferganense</i> Bobr. 45,	713	" <i>pratense</i> L.	31
" <i>finitimum</i> Woron.	34	" " ssp. v. <i>finitimum</i> (Wo-	
" <i>foetidum</i> Gilib.	35	" " " β . <i>Ruprechtii</i>	34
" " var. <i>glabriusculum</i>		" " " Knuth	33
" " Alb.	46	" " " β . <i>affine</i> (Ldb.)	33
" " var. <i>trilobum</i> Boiss.	46	" " " β . <i>cyanostemon</i>	
" <i>gracile</i> Schrenk	13	" " " Bolss.	33
" <i>grandiflorum</i> Edgew.	45	" <i>pseudosibiricum</i> auct.	30
" " Gilib.	10	" <i>pseudosibiricum</i> J. Mayer . . 29,	30
" " Gld.	19	" " var. <i>euglandu-</i>	
" <i>gymnocaulon</i> DC.	18	" " <i>losum</i> Trautv.	29
" " var. <i>grandiflo-</i>		" " " <i>glandulo-</i>	
" " <i>rum</i> Rupr.	19	" " <i>sum</i> Trautv.	29
" <i>pumilum</i> Rupr.	19	" <i>psilostemon</i> Ldb.	18
" <i>ibericum</i> Cavan.	19	" <i>purpureo-coeruleum</i> Ldb. . .	24
" " var. <i>genuinum</i> Trautv.	20	" <i>purpureum</i> Gilib.	40
" " " <i>hyrcanum</i> Woron.	20	" " Vill.	36
" " " <i>platypetalum</i> Bo-		" <i>pusillum</i> Burm. f.	52
" " " iss.	20	" <i>pyrenaicum</i> Burm. f.	51
" " " <i>subglandulosum</i>		" " var. <i>depilatum</i>	
" " Rupr.	20	" " <i>Somm. et Lev.</i>	52
" " β . M. B.	20	" " " <i>velatinum</i> Bo-	
" " γ . <i>brachytrichum</i> Boiss.	18	" " " iss. et Buhse	52
" <i>japonicum</i> Fr. et Sav.	22	" <i>radicatum</i> M. B.	60
" <i>Kotschyi</i> Boiss.	92	" <i>rectum</i> Trautv.	30
" <i>laetum</i> Ldb.	29	" " var. <i>glabrata</i> Trautv.	31
" <i>lejocaulon</i> Ldb. 55,	56	" " " <i>villosula</i> Trautv. .	31
" <i>linearilobum</i> DC.	61	" " " <i>villosum</i> Rgl. . . .	31
" <i>lividum</i> L'Hr.	39	" <i>Regelii</i> Nevski	44
" <i>Londesii</i> Fisch.	43	" <i>Renardii</i> Trautv.	17
" <i>longipedatum</i> St. Lag. . . .	43	" <i>Renardii</i> \times Ger. <i>platypetalum</i>	17
" <i>longipes</i> DC.	43	" <i>Richardsonii</i> F. Mey. . . .	22
" " var. <i>adenotrichum</i>		" <i>Robertianum</i> L.	35
" " Schrenk	43	" " var. <i>purpureum</i>	
" <i>lucidum</i> L.	36	" " (Vill.) DC.	36
" <i>macrorrhizum</i> L.	34	" " " <i>tenuisectum</i>	
" <i>maculatum</i> Ldb.	23	" " " Alb	35
" <i>malacoides</i> L.	69	" " v. <i>mosquense</i>	
" <i>Maximowiczii</i> Rgl. et Maack .	42	" " Ldb.	35
" <i>Meeboldii</i> Briquet	45	" <i>roseo-coeruleum</i> Gilib. . . .	13
" <i>moldavicum</i> nom.	39	" <i>rotundifolium</i> L.	56
" <i>molle</i> L.	55	" <i>Ruprechtii</i> Woron.	33
" " var. <i>caucasicum</i> Rgl. . .	55	" " var. <i>Buschianum</i> Wo-	
" <i>montanum</i> Hbl	20	" " <i>ron.</i>	34
" <i>mosquense</i> Goldb.	35	" " " <i>diffusum</i> Woron.	34
" <i>nodosum</i> Ldb.	46	" <i>ruthenicum</i> Uechtr. . . 57, 58,	59
" <i>orientale</i> Freyn 23,	24		

<i>Geranium sanguineum</i> L.	10	<i>Geranium Vvedenskyi</i> Bobr.	62
" <i>saxatile</i> Kar. et Kir.	44	" <i>Wiltfordii</i> Maxim.	49
" <i>Schrenkianum</i> Trautv.	13	<i>Goniocarpa</i> Pojark., sect.	612
" <i>selenium</i> Prodan	41		
" <i>sibiricum</i> L.	57, 59	<i>Halmiphycium</i> Engl., sect.	189
" " ssp. <i>eu-sibiricum</i>		<i>Halmiphycium</i> (Engl.) Boriss., subgenus 189, 729	
Gams 57		<i>Haplophyllum</i> A. Juss.	200
" " " <i>ruthenicum</i>		" <i>acutifolium</i> (DC.) G. Don 226	
(Uechtr.) Gams 57		" <i>affine</i> (Aitch. et Hemsl.) Eug. Kor. 212	
" <i>Sieboldii</i> Maxim.	21	" <i>Alberti-Regelli</i> Eug. Kor. 221	
" <i>silvaticum</i> L.	24	" " f. <i>subternata</i> Eug. Kor. 220	
" " var. <i>albiflorum</i> Kryl. 27		" <i>badghysi</i> Eug. Kor.	212
" " " <i>alpinum</i> Rupr. 27		" <i>Besseri</i> Spach	208
" " " <i>hirsutum</i> Rupr. 27		" <i>Biebersteinii</i> Spach	208
" " " <i>myriadenum</i> Somm. et Lev. 27		" <i>Bourgaei</i> Boiss.	211
" <i>soboliferum</i> Kom.	12	" <i>brevipilum</i> Freyn et Sint. 224	
" <i>Sophiae</i> An. Fed.	40	" <i>bucharicum</i> Litv.	211
" <i>subcaulescens</i> L'Her.	10	" <i>Bungei</i> Trautv.	22
" " var. <i>lazicum</i> Woron. 10		" <i>ciliatum</i> Griseb.	208
" <i>szcewalskianum</i> Prodan	29	" <i>ciscaucasicum</i> Grossh. et Vved. 218	
" <i>tataricum</i> Poir.	66	" <i>congestum</i> Spach	207
" <i>tauricum</i> Rupr.	50	" <i>dauricum</i> (L.) G. Don	205
" <i>transbaicalicum</i> Serg.	32, 34	" <i>dshungaricum</i> Rubtz.	215
" <i>transversale</i> (Kar. et Kir.) Vved. 61, 62		" <i>dubium</i> Eug. Kor.	220
" <i>trilobum</i> C. Koch	46	" <i>elatatum</i> Fisch. et Mey.	222
" <i>tuberosum</i> L.	60	" <i>Eugentii-Korovinii</i> Pavl.	213
" " ssp. <i>linearilobum</i> (DC.) Kryl. 61		" <i>ferganicum</i> Vved.	223
" " var. <i>Charlesii</i> Aitch. et Hemsl. 62		" <i>foliosum</i> Vved.	216
" " " <i>genuinum</i> Boiss. 60		" <i>halepense</i> Spach	220
" " " <i>incisodentatum</i> Woron. 60		" <i>hirsutum</i> Rgl. et Schmalh. 206	
" " " <i>linearilobum</i> Boiss. 61		" <i>hispidulum</i> Bge.	224
" " " <i>pinnatifidum</i> Woron. 60		" <i>Kowalenskii</i> Stscheg.	212
" " " <i>radicatum</i> O. Ktze. 60		" <i>lasianthum</i> Bge.	224
" " " <i>linearilobum</i> Schm. 61		" <i>latifolium</i> Kar. et Kir.	225
" " <i>transversale</i> Kar. et Kir. 61		" <i>leptomerum</i> Lincz. et Vved. 217, 731	
" <i>tuberosum</i> M. B.	61	" <i>monadelphum</i> C. Afan.	215
" <i>versicolor</i> Turcz.	27, 29	" <i>multicaule</i> Vved.	213, 731
" <i>viscosum</i> Gilib.	56	" <i>nigripes</i> Nevski	211
" <i>Vlassovianum</i> Fisch.	41	" <i>obtusifolium</i> Ldb.	214
" " f. <i>setosopilosa</i> Maxim. 42		" " var. <i>eriocarpum</i> Freyn et Sint. 214	
		" " " <i>ramosissimum</i> Pauls. 214	
		" " " <i>β.</i> Bge.	214
		" " " <i>γ.</i> Bge.	214
		" <i>pedicellatum</i> Bge.	206
		" " var. <i>villosum</i> Zinger 206	

Haplophyllum perforatum (M. B.) Kar.			
	et Kir.	226	
" pilosum Franch.		206	
" Popovii Eug. Kor.		222	
" ramosissimum Vved.		214	
" robustum Bge.		223	
" Schelkovnikovii Grossh.		219	
" Sieversii Fisch.		226	
" suaveolens (DC.) G.			
	Don 207,	208	
" suaveolens Ldb.		226	
" subcordatum Bge.		212	
" sublanatum Freyn.		206	
" tauricum Spach.		207	
" tenue Boiss.		217	
" tenuisectum Lincz. et			
	Vved. 216,	732	
" thesioides G. Don.		207	
" versicolor Bge.		222	
" versicolor Fisch. et Mey.		224	
" villosum (M. B.) G. Don.		218	
" " var. ciscaucasicum			
	Rupr.	218	
" " " glabrescens			
	Boiss. et Buhse	217	
" " " Vvedenski Nevski.		220	
Hedera Eichwaldii Palib.		584	
Hedera quinquefolia L.		708	
Helioscopiae Prokh., subsect.		383	
Herpetorrhiza Prokh., sect.		456	
Heteromorpha Juz.		110	
Hexakistra Hook. f.		269	
Hippocastanaceae DC.		622	
Hippocastanum vulgare Gaertn.		622	
Holophyllum Prokh., sect.		337	
Halophyllum Prokh., subgenus		337	
Homomorpha Juz.		105	
Hovenia Thunbergii (Nath.) Baik.		635	
Hydrocera Bl.		624	
Ilex L.		540	
" ambigua Ung.		540	
" aquifolium auct.		543	
" aquifolium L.		541	
" " var. angustifolia Hohe-			
	nack.	544	
" " " caspia Loes.		542, 544	
" " " " f. angu-			
	stifolia Loes.	542, 544	
" " " " f. spini-			
	gera Loes.	544	
" " " " occidentalis Loes.		541	
" " " " f. ferox Ait.		542	
Ilex aquifolium var occidentalis f. integri-			
	folia Nolte	542	
" " " " laurifolia			
	Loud.	542	
" aquifolium L.		540	
" aquifolium Ldb.		544	
" " M. B.		542	
" colchica Pojark.		542	
" crenata Thunb.		544	
" " var. genuina Loes.		544	
" " ssp. radicans (Nakai) Tabew			
	et Mimoto	545	
" echinata Mill.		542	
" Falsanii Sap. et Mar.		540	
" Fortunei hort.		544	
" hyrcana Pojark.		544	
" insignis Heer.		540	
" longifolia Heer.		540	
" pacifica Baik.		540	
" radicans Nakai		545	
" rotundata Thunb.		546	
" rugosa Fr. Schmidt.		545	
" Schmidiana Heer.		540	
" stenocarpa Pojark.		543	
" stenophylla Heer.		540	
" sp.		540	
Ilicifolius Nakai, sect.		552	
Impatiens L.		624	
" balsamina L.		633	
" borealis Sweet		626	
" brachycentra Kar. et Kir.		632	
" caucasica Stev.		626	
" cleistogama M. Pop.		626	
" furcillata Hemsley.		627	
" glandulifera Lindl.		634	
" " Royle		634	
" Komarovii Pob.		631	
" lutea Lam.		626	
" Maackii Hook.		627	
" moschata Edgew.		634	
" Nevskii Pob.		632, 746	
" noli me-tangere Crantz		626	
" noli-tangere L.		626	
" " var. minutiflora			
	Meinsh.	626	
" pachycentra Rupr.		626	
" pallida Nutt.		627	
" palustris Pers.		626	
" parviflora DC.		631	
" " var. brachycentra B.			
	Fedtsch.	632	
" " " brachyceras			
	Trautv.	632	

<i>Impatiens parv. var. typica</i> Trautv.	631
" <i>penduliflora</i> St. Lag.	626
" <i>Royleana</i> Payer	634
" <i>Roylei</i> Walp.	633
" <i>Textori</i> Miq.	628

<i>Jathropheae</i> Pax, tribus	302
--	-----

<i>Kalonymopsis</i> Prokh., sect.	558, 744
---	----------

<i>Kalonymus</i> Beck, subgen.	566
--	-----

Kalonymus (G. Beck) Prokh.	566, 744
---	----------

" <i>latifolia</i> (Mill.) Prokh.	569
---	-----

" <i>leiophloea</i> (Stev.) Prokh.	572
--	-----

" <i>macroptera</i> (Rupr.) Prokh.	573
--	-----

" <i>Maximowicziana</i> Prokh.	570, 744
--	----------

" <i>sachalinensis</i> (F. Schmidt)	
-------------------------------------	--

Prokh. 571, 745	
-----------------	--

" <i>yesoensis</i> (Koidz.) Prokh.	568
--	-----

<i>Kalopanax pictum</i> Nakai	590
---	-----

" <i>ricinifolium</i> (S. et Z.) Miq.	590
---	-----

<i>Keraselma</i> Neck.	309
--------------------------------	-----

<i>Koelreuteria caucasica</i> Palib.	624
--	-----

" <i>serrata</i> Heer	624
---------------------------------	-----

<i>Lepidocarpa</i> Prain, sect.	290
---	-----

<i>Lepidocroton</i> Presl.	288
------------------------------------	-----

<i>Limoniopsis</i> Planch., sect.	130
---	-----

<i>Linaceae</i> Dumort.	84
---------------------------------	----

<i>Linopsis</i> (Rchb.) Planch., sect.	128
--	-----

Linum L.	86
-------------------------	----

" <i>africanum</i> hort.	99
----------------------------------	----

" <i>agreste</i> Bröt.	95
--------------------------------	----

" <i>Alexeenkoanum</i> E. Wulff	130
---	-----

" <i>alpinum</i> Korsh.	111
---------------------------------	-----

" <i>alpinum</i> L.	110
-----------------------------	-----

" " <i>β. elatius</i> Wahlenb.	115
--	-----

" " Pall.	120
-------------------	-----

" <i>altaicum</i> Ldb.	113, 114, 717
--------------------------------	---------------

" <i>amurense</i> Alef. p. p.	109
---------------------------------------	-----

" <i>amurense</i> Alef. s. str.	110
---	-----

" <i>anglicum</i> Mill.	110
---------------------------------	-----

" <i>angustifolium</i> Huds.	94, 95
--------------------------------------	--------

" <i>apiculatum</i> Franch. et Rochebr.	125
---	-----

" <i>atricalyx</i> Juz.	114, 719
---------------------------------	----------

" <i>Aucheri</i> Planch.	93, 94
----------------------------------	--------

" <i>aureum</i> DC.	128
-----------------------------	-----

" <i>aureum</i> Waldst. et Kit.	129
---	-----

" <i>austriacum</i> L.	123
--------------------------------	-----

" " <i>α. pratense</i> Neilr.	123
---------------------------------------	-----

" " <i>β. M. B.</i>	120
-------------------------------	-----

" " <i>v. squamulosum</i> Boiss. 118, 123	
---	--

" <i>baicalense</i> Juz.	109, 715
----------------------------------	----------

" <i>Balansae</i> Boiss.	130
----------------------------------	-----

Linum basarabicum (Savul. et Rayss)	
--	--

Klok. 133	
-----------	--

" <i>bavaricum</i> Schultz	116
--------------------------------------	-----

" <i>Beauharnaisianum</i> Spadoni	116
---	-----

" <i>bienne</i> Mill.	99
-------------------------------	----

" <i>boreale</i> Juz.	111, 718
-------------------------------	----------

" <i>brevisepalum</i> Juz.	117, 720
------------------------------------	----------

" <i>campanulatum</i> M. B.	131
-------------------------------------	-----

" " Pall.	136
-------------------	-----

" <i>carnosulum</i> Boiss.	124
------------------------------------	-----

" <i>catanense</i> Strobl	99
-------------------------------------	----

" <i>catharticum</i> L.	127
---------------------------------	-----

" " ssp. <i>β. sueticum</i> Hayek	127
-----------------------------------	-----

" " " <i>β. subalpinum</i>	
----------------------------	--

Hauskn. 128	
-------------	--

" " f. <i>annuum</i> Betner	127
---------------------------------------	-----

" " " <i>bienne</i> Betner	127
--------------------------------------	-----

" <i>cilicicum</i> Fenzl	125
------------------------------------	-----

" <i>corymbulosum</i> Rchb.	128
-------------------------------------	-----

" <i>crepitans</i> Dum.	96
---------------------------------	----

" <i>cretaceum</i> Juz.	143
---------------------------------	-----

" <i>Czernjaëvii</i> Klok.	135
------------------------------------	-----

" <i>Czernjaëvii</i> Klok. × <i>flavum</i> L.	135
---	-----

" <i>darmstadtinum</i> Alef.	116
--------------------------------------	-----

" <i>dehiscens</i>	94
------------------------------	----

" " ssp. <i>angustifolium</i> Vav.	
------------------------------------	--

et Ell. 95	
------------	--

" " " <i>crepitans</i> Vav. et	
--------------------------------	--

Ell. 96	
---------	--

" <i>diversifolium</i> Gilib.	127
---------------------------------------	-----

" <i>euxinum</i> Juz.	118, 721
-------------------------------	----------

" <i>extraaxillare</i> Kit.	115
-------------------------------------	-----

" <i>Fedtschenkoae</i> Rgl.	145
-------------------------------------	-----

" <i>Fedtschenkowae</i> Korolkow	145
--	-----

" <i>flavum</i> L.	136
----------------------------	-----

" <i>flavum</i> ssp. <i>tauricum</i> a) <i>basara-</i>	
--	--

<i>bicum</i> Savulescu et Rayss	
---------------------------------	--

" " " <i>β. tauricum</i> Schmalh.	
-----------------------------------	--

131—134	
---------	--

" " var. <i>angustifolium</i> Jävorka	136
---------------------------------------	-----

" " " <i>orientale</i> Boiss. et	
----------------------------------	--

Heldr. 130	
------------	--

" " <i>α. linearifolium</i> Lin-	
----------------------------------	--

dem. 133, 134	
---------------	--

" " <i>α. typicum</i> Fiori e Paoletti	136
--	-----

" " <i>β. latifolium</i> Beck	136
---	-----

" " <i>β. lanceolatum</i> Lindem.	136
---	-----

" " v. <i>ovatum</i> Lindem.	136
--------------------------------------	-----

" " Ldb.	130
------------------	-----

" <i>gallicum</i> auct.	128
---------------------------------	-----

" <i>gallicum</i> L.	129
------------------------------	-----

" " ssp. <i>β. corymbulosum</i>	
---------------------------------	--

Schmalh 128	
-------------	--

<i>Linum glandulosum</i> β. <i>campanulatum</i>	<i>Linum nerv.</i> β. <i>glabratum</i> DC.	92
DC. 131, 132	" " f. <i>glabratum</i> DC.	92
" " v. <i>tauricum</i> DC.	" <i>nodiflorum</i> Ldb.	139
" " ε. <i>flavum</i> DC.	" <i>Olgae</i> Juz.	145
" <i>grandiflorum</i> Pall.	" <i>orientale</i> Boiss.	130
" <i>heterosepalum</i> Rgl.	" <i>Pallasianum</i> Schuit.	132
" <i>heterosepalum</i> ssp. <i>Olgae</i> Vved.	" <i>Pallasianum</i> E. Wulff	135
" " " <i>tianschanicum</i>	" <i>pallescens</i> Bge.	106
Vved. 144	" <i>perenne</i> Kom.	110
" " var. <i>purpureum</i>	" <i>perenne</i> L.	116
Franchet 145	" <i>perenne</i> Ldb. p. p. 109, 112, 113,	
" <i>heterosepalum</i> Trautv.	116, 123	
" <i>hirsutum</i> auct.	" " ssp. α. <i>genuinum</i> Schmalh.	116
" <i>hirsutum</i> L.	" " β. <i>austriacum</i> Schmalh.	123
" " α. <i>angustifolium</i> Ldb.	" " v. <i>squamulosum</i>	
" " α. <i>genuinum</i> Neilr.	Schmalh.	118
" " α. <i>typicum</i> Beck	" " var. <i>alpicola</i> M. Pop.	113
" " β. <i>latifolium</i> Ldb.	" " " <i>carpaticum</i> Uechtritz	115
" " v. <i>subglabrum</i> Ldb.	" " α. <i>sibiricum</i> Schiede	116
" <i>hirsutum</i> M. B.	" " β. <i>austriacum</i> Schiede	123
" <i>hispanicum</i> Mill.	" " <i>euperenne</i> Hermann	116
" " F. N. Williams	" <i>pubescens</i> Willd.	132
" <i>Hohenackeri</i> Boiss.	" <i>pusillum</i> Pall.	139
" <i>humile</i> Mill.	" <i>pyrenaicum</i> Pourr.	95
" <i>humile</i> Planch.	" <i>Radiola</i> L.	85
" <i>hypericifolium</i> Salisb.	" <i>rubens</i> Pall.	125
" <i>indehiscens</i>	" <i>sibiricum</i> Alef.	106
" " ssp. <i>curasiaticum</i> prol.	" " Bge.	113
<i>brevimulticaulia</i> Vav. et Ell. 102	" <i>sibiricum</i> DC.	116
" " " prol. <i>elonga-</i>	" " var. <i>parviflora</i> Ldb.	108
<i>ta</i> Vav. et Ell. 100	" " Turcz.	109, 117
" " " prol. <i>prostra-</i>	" <i>spicatum</i> Pers.	129
<i>ta</i> Vav. et Ell. 99	" <i>squamulosum</i> DC.	118
" <i>jailicola</i> Juz.	" " Rudolphi	119, 123
" <i>karataviense</i> Pavl.	" " Stev.	120
" <i>Karoi</i> Freyn	" <i>stelleroides</i> Planch.	125
" <i>kirgisicum</i> Alef.	" <i>sterile</i> Stapf	115
" <i>Komarovii</i> Juz.	" <i>Stevenianum</i> Juz.	124
" <i>lanuginosum</i> Juz.	" <i>Stocksianum</i> Boiss.	106
" <i>lazicum</i> Boiss.	" " Grossh.	110
" <i>Leonii</i> F. Schultz	" <i>strictum</i> auct. plur.	128
" <i>liburnicum</i> auct.	" " β. <i>corymbulosum</i> Planch.	128
" <i>linearifolium</i> Jávorka	" <i>subbiflorum</i> Juz.	110, 716
" <i>luteolum</i> M. B.	" <i>suecicum</i> Murb.	127, 128
" <i>macrorhizum</i> Juz.	" <i>tauricum</i> auct.	130, 134
" <i>marginatum</i> Poir.	" " Korsh.	135
" <i>Marschallianum</i> Juz.	" <i>tauricum</i> Willd.	131
" <i>mesostylum</i> Juz.	" " β. <i>Pallasianum</i> Boiss.	132
" <i>monopetalum</i> Steph.	" <i>tenuifolium</i> L.	125
" <i>mucronatum</i> Bertol.	" <i>tetrapetalum</i> Gilib.	85
" <i>multiflorum</i> Lam.	" <i>trigynum</i> L.	129
" <i>nervosum</i> auct.	" <i>turcomanicum</i> Juz.	114, 72
" <i>nervosum</i> Waldst. et Kit.	" <i>ucranicum</i> Czern.	13

Linum ucran. <i>α. glabrum</i> Czern.	134	Migratoria Tamamsch., sect.	
" " <i>β. pubescens</i> Czern.	135	Miltianthus Bge.	
" uralense Juz.	135, 722	" <i>portulacoides</i> Bge.	
" <i>usitatissimum</i> auct.	102	Miltianthus (Bge.) Boriss., subgenus	
" <i>usitatissimum</i> L.	100	Murtekias Prokh., subgenus	
" " <i>ssp. angustifolium</i>		Raf.	3
" " Thell.	95	Murtekias (Raf.) Prokh., sect.	3
" " <i>hispanicum</i> Thell.	95	Myrrhina <i>anthemoides</i> M. B.	
" " <i>α. indehiscens</i> Neitr.	100	" <i>fumarioides</i> Rupr.	
" " <i>typicum</i> Pospich.	100	" <i>gunibensis</i> Rupr.	
" " <i>vulgare</i> Bönningh.	100	Myrsiniteae Boiss., subsect.	
" " <i>β. crepitans</i> Boenn.	96		
" " <i>β. humile</i> DC.	102	Negundium Raf.	
" " <i>A. vulgare</i> II. <i>bienne</i>		" <i>fraxinifolium</i> Raf.	
" " Asch. et Graebn.	99	Negundo Ludw.	
" " <i>2. hyemale romanum</i>		Negundo (Ludw.) C. Koch, sect.	
" Heer	99	" <i>aceroides</i> Moench	
" <i>usitatissimum</i> (L.) Vav.	94	" <i>amurensis</i> Krysh.	
" <i>venustum</i> Andrews	140	" <i>fraxinifolium</i> Nutt.	
" <i>violascens</i> Bge.	108	" <i>mandschurica</i> Budistch.	
" <i>viscosum</i> <i>δ. hypericifolium</i> DC.	140	" <i>negundo</i> Karst.	
" <i>Wetschkyanum</i> Fick.	132	" <i>virginianum</i> Medik.	
Lutescentes Prokh., subsect.	348, 370, 381, 735	Neo-Empetrum V. Vassil., sect.	
		Nitraria L.	
Macrantha Pax, sect.	609	" <i>caspica</i> W.	
Macrantholinum Juz., sect.	143	" Komarovii Iljin et Lava	
Malacocarpus Fisch. et Mey.	150	" Schoberi L.	
" <i>crithmifolius</i> (Retz.) C. A. M.	150	" var. <i>caspica</i> Pall.	
Mediterranea Knuth, subsect.	17	" " <i>polygama</i> Trautv.	
Melanocarya Turcz.	557	" " <i>α. sibirica</i> DC.	
Melanocarya (Turcz.) Nakai, sect.	557	" " <i>β. caspica</i> DC.	
Melia L.	244	" " <i>β. sibirica</i> Pall.	
" <i>azedarach</i> L.	244	" " <i>β. W.</i>	
" var. <i>japonica</i> Makino	244	" <i>Schoberi</i> Ldb.	
" <i>japonica</i> Don.	244	" <i>sibirica</i> Pall.	
Meliaceae Vent.	244	Nitrarioideae Engl., subfam.	
Mercurialinae Pax, subtribus	295		
Mercurialis L.	295	Oleraceae Prokh., subsect.	459
" <i>alpina</i> Schur.	296	Oligoon Vved., sect.	
" <i>annua</i> L.	298	Oporinocissus Koehne et Graebn., sect.	
" <i>cynocrambe</i> Scop.	296	Oppositifoliae Boiss., subsect.	459
" <i>livida</i> Portenschl.	297	Oppositifolium Prokh., sect.	459
" <i>longifolia</i> Host	296	Orthopolygala , sect.	
" <i>nemoralis</i> Salisb.	296	" subsect. XIV Chod.	
" <i>ovata</i> Sternb. et Hoppe	297	Oxalidaceae Lindl.	
" " " " × <i>M. pe-</i>		Oxalis L.	
" " " " <i>rennis</i> L.	298	" <i>acetosella</i> L.	
" <i>perennis</i> L.	296	" var. <i>purpurascens</i> Mart	
" var. <i>ovata</i> Müll.	297	" " <i>f. rosea</i>	
" <i>sylvatica</i> Hoppe	296	" <i>cernua</i> Thunb.	
Microcarpa Pojark., sect.	604	" <i>corniculata</i> L.	
Microcentron Warb., sect.	633	" " <i>β. villosa</i> Hohen.	
		" <i>obtriangulata</i> Maxim.	

<i>Oxalis pes-caprae</i> L.	82	<i>Pelargonium roseum</i> Willd.	72
" <i>stricta</i> L.	78	" <i>zonale</i> (L.) Alton	72
" <i>villosa</i> M. B.	77	<i>Pentaspalon</i> Hook. f.	518
" <i>violacea</i> L.	81	<i>Petrophilae</i> Grub., subsect.	666
<i>Fachysandra</i> Mchx.	503	<i>Pharnaceum suffruticosum</i> Pall.	283
" <i>terminalis</i> S. et Z.	504	<i>Phellodendron</i> Rupr.	232
" " var. <i>variegata</i>		" <i>amurense</i> Rupr.	232
Mann.	504	<i>Phellodendron</i> sp.	232
<i>Palaeocissus</i> Koehue et Gaertn., sect.	708	<i>Phyllanthaeae</i> Pax, tribus	268
<i>Palaeo-Empetrum</i> V. Vassil., sect.	517	<i>Phyllanthinae</i> Pax, subtribus	182
<i>Paliurus</i> Mill.	635	<i>Phyllanthoideae</i> Pax, subfam.	268
" <i>aculeatus</i> Lam.	636	<i>Phyllanthus</i> L.	287
" <i>australis</i> Gaertn.	636	" <i>ramiflorus</i> Pers.	283
" <i>Colombii</i> Heer.	636	" <i>simplex</i> Kom.	287
" <i>spina Christi</i> Miller	636	" <i>ussuriensis</i> Rupr. et Maxim.	287
" <i>trinervatus</i> Moench	636	<i>Pimpinellaefolia</i> J. et Sp., subdiv.	74
" <i>zaporogensis</i> Krysh.	636	<i>Pistacia</i> L.	519
" sp.	636	" <i>atlantica</i> DC.	524
<i>Palmata</i> Pax, sect.	608	" <i>cabulica</i> Stocks	523
<i>Palustria</i> Knuth, sect.	31, 40	" <i>khinjuk</i> Kordon	524
<i>Papilionacea</i> Chod.	252	" " <i>Stoks</i>	523
<i>Paralias</i> Rafin.	308	" <i>miocenica</i> Unger	519
<i>Paralias</i> (Rafin.) Prokh., subgenus	308, 309	" <i>mutica</i> F. et M.	524
<i>Paralioideae</i> Prokh., subsect.	391, 738	" <i>narbonensis</i> L.	520
<i>Parthenocissus</i> Planch.	707	" <i>Popovii</i> Lincz.	523
" <i>dumetorum</i> Rehd.	709	" <i>terebinthus</i> F. et M.	524
" <i>inserta</i> (Kern.) K. Fritsch.	709	" <i>trifolia</i> L.	520
" <i>quinquefolia</i> Graebn.	709	" <i>vera</i> L.	520
" <i>quinquefolia</i> (L.) Planch.	709	<i>Platanoidea</i> Pax, sect.	588
" <i>Spaethii</i> Graebn.	709	<i>Plumosa</i> Boiss., sect.	64
" <i>tricuspidata</i> (Sieb. et Zuc.)		<i>Polygala</i> L.	246
Planch.	708	" <i>alpestris</i> Boiss.	258
" <i>vitacea</i> Hitchcock	709	" <i>alpicola</i> Rupr.	258
" <i>Weitchii</i>	708	" <i>amara</i> ssp. <i>amarella</i> Chodat.	257
" sp.	707	" " <i>narella</i> var. <i>aust-</i>	
<i>Patellares</i> Prokh., subsect.	453, 743	<i>riaca</i> Chodat	256
<i>Paulinia japonica</i> Thunb.	706	" " " <i>brachypetala</i> Hayek	257
<i>Pedilanthus</i> Neck.	309	" " var. <i>carpatica</i> Wol.	257
<i>Peganoideae</i> Engl., subfam.	147	" " " <i>minor</i> Trautv.	258
<i>Peganoidea</i> Spach, sect.	205	" " subvar. <i>brachyptera</i> Cho-	
<i>Peganum</i> L.	147	dat	257
" <i>crithmifolium</i> Retz.	150	" " β . <i>alpestris</i> Ldb.	258
" <i>dauricum</i> L.	205	" " β . <i>austriaca</i> Lam.	256
" <i>harmala</i> L.	148	" " Ldb.	257
" " β . <i>multisecta</i> Maxim.	149	" <i>amarella</i> Crantz	257
" " β . <i>stenophyllum</i> Boiss.	149	" <i>amoenissima</i> Tamamsch.	262
" " β . DC.	150	" <i>anatolica</i> Boiss. et Heldr.	265
" <i>multisectum</i> (Maxim.) Bobr.	149	" " var. <i>floribunda</i> Boiss.	265
" <i>nigellastrum</i> Bge.	149	" " f. <i>alba</i> Woron.	266
<i>Pelargonium</i> L'Hér.	72	" " f. <i>rosea</i> Woron.	266
" <i>Endlicherianum</i> Fenzl.	73	" <i>andrachnoides</i> Willd.	255
" <i>radula</i> (Cav.) L'Hér.	72	" <i>austriaca</i> Crantz	256
		" <i>brachyptera</i> Szaf.	257

<i>Polygala caucasica</i> Rupr.	259	<i>Polygala subamara</i> Fritsch	257
" " var. <i>abchasica</i> Tamamsch.	259	" <i>supina</i> Ldb.	255
" " " <i>alpigena</i> Tamamsch.	259	" <i>supina</i> Schreb.	254
" " " <i>zangesura</i> Tamamsch.	259	" " ssp. <i>pseudohospita</i> Tamamsch.	254
" <i>colchica</i> Tamamsch.	263, 733	" " var. <i>andrachnoides</i> Chodat	255
" <i>comosa</i> Ldb.	260	" " " <i>hospita</i>	256
" " var. <i>altaica</i> Chodat	260	" " " <i>pseudohospita</i> Tamamsch.	255
" " α. <i>hybrida</i> Schmalh.	260	" <i>tenuifolia</i> Willd.	247, 251
" <i>comosa</i> Schkuhr	261	" <i>transcaucasica</i> Tamamsch.	265
" <i>cretacea</i> Kotov	262	" <i>Urtutu</i> Tamamsch.	264
" <i>decipiens</i> Bess.	256	" <i>vulgaris</i> L.	259
" <i>Gundelsheimeri</i> C. Koch	254	" " ssp. <i>comosa</i> Chodat	261
" <i>Hakobii</i> Tamamsch.	251	" <i>Wolfgangiana</i> Besser	260, 261
" <i>Hohenackeriana</i> Fisch. et Mey.	253	Polygalaceae Lindl.	246
" " var. <i>Storksiana</i> Chodat	254	<i>Polygalastrum</i> Tamamsch., subsect.	252
" <i>hospita</i> Heuff.	255	<i>Polygalella</i> Tamamsch., subsect.	254
" <i>hybrida</i> DC.	260	<i>Polygalon</i> DC., sect.	252
" <i>hybrida</i> Rupr.	265	<i>Polyoon</i> Vved., sect.	206
" " auct.	262	Poncirus Raf.	234
" <i>japonica</i> Houttuyn	252	" <i>trifoliata</i> (L.) Raf.	234
" <i>Kemulariae</i> Tamamsch.	265, 733	" " × <i>Citrus unshiu</i>	234
" <i>leucothyrsa</i> Voron.	264	<i>Pongelion</i> Adans.	241
" <i>magna</i> Georgi	262	" <i>glandulosum</i> Pierre	242
" <i>major</i> auct.	261, 262	<i>Pragmotessara</i> Pierre	553
" <i>major</i> Jacq.	262	<i>Pragmotessara</i> (Pierre) Nakai, sect.	553
" " var. <i>alata</i> Tamamsch.	263	<i>Principales</i> Grub., subsect.	656
" " " <i>anatolica</i> Chodat	265	<i>Protolinum</i> Planch., sect.	92
" " " f. <i>floribunda</i> Chod.	265	<i>Psedera</i> Necker	707
" <i>Mariamae</i> Tamamsch.	263	" <i>quinquefolia</i> Greene	709
" <i>microcarpa</i> Chodat	258	" <i>tricuspidata</i> Rehder	708
" <i>moldavica</i> Kotov	261	" <i>vitacea</i> Greene	709
" <i>nicaeensis</i> Grossh.	256	<i>Pseudaegle sepiaria</i> Miq.	234
" " Risso	265	<i>Pseudocallitriche</i> Hegelm., sect.	502
" <i>papilionacea</i> Boiss.	253	<i>Pseudococcus</i> Boriss., subgenus	193, 731
" <i>pinetorum</i> Alech.	261	<i>Pseudokeraselma</i> Prokh., sect.	383
" <i>podolica</i> DC.	261	<i>Pseudovyenomus</i> Nakai	558
" <i>pruinosa</i> Boiss.	256	Ptelea L.	233
" <i>pseudohospita</i> Tamamsch.	255	" <i>trifoliata</i> L.	233
" <i>Senega</i> L.	246	<i>Pterocarpium</i> Boiss., sect.	172, 725
" <i>sibirica</i> L.	247, 250	<i>Purpuratae</i> Prokh., subsect. 370, 372, 381, 737	
" " var. <i>ciliata</i> Tamamsch.	251	<i>Pyrenaica</i> Knuth, sect.	49
" " " <i>Hakobii</i> Tamamsch.	251	<i>Pythiusa</i> Rafin., subgenus	348
" " " <i>tenuifolia</i> Chodat	251	<i>Quadriovulata</i> Boiss., §	206
" " β. <i>angustifolia</i> Ldb.	251	<i>Quinaria</i> Raf.	707
" <i>Sieboldiana</i> Miq.	252	" <i>quinquefolia</i> Koehne	709
" <i>spuria</i> Stev.	260	" <i>tricuspidata</i> Koehne	708
" <i>Stocksiana</i> Boiss.	254	Radiola Roth.	85
" <i>suanica</i> S. Tamamsch.	258	" <i>dichotoma</i> Moench	85

<i>Radiola linoides</i> Roth.	85	<i>Rhamnus erythr.</i> $\beta.$ <i>angustifolius</i> DC.	669
" <i>Millegrana</i> Smith	85	" <i>erythroxylon</i> Pall.	666
" <i>multiflora</i> Aschers.	85	" " var. $\beta.$ <i>angustifolius</i>	666
" <i>Radiola</i> Karst.	85	" <i>fallax</i> Boiss.	654
<i>Recurvata</i> Knuth, subsect.	31	" <i>Frangula</i> L.	642
<i>Reflexa</i> Knuth, sect.	39	" <i>Gaudinii</i> Heer	647
<i>Rhamnaceae</i> R. Br.	634	" <i>globosa</i> Bge.	646
<i>Rhamnales</i> Engl.	634	" " Kom.	662
<i>Rhamneae</i> Benth. et Hook., tribus	638	" <i>Graefii</i> Heer	647
<i>Rhamniphyllum ussuriense</i> Krysh.	648	" <i>grandifolia</i> $\beta.$ <i>brachypus</i> Boiss.	654
<i>Rhamnus</i> L.	645	" <i>grandifolius</i> F. et M.	643
" <i>acuminatifolia</i> D. Web.	647	" <i>hypochrysa</i> Schneid.	656
" <i>aizoon</i> Heer	647	" <i>imeretina</i> Booth.	654, 644
" <i>alaternus</i> L.	653, 646	" cf. <i>inaequalis</i> Heer	647
" " var. <i>angustifolia</i> Willd.	653	" <i>infectoria</i> L.	646, 665
" " " $\alpha.$ <i>balearicus</i>	653	" <i>japonica</i> Maxim.	662
" " " $\beta.$ <i>hispanicus</i>	653	" <i>ketmentica</i> Lipsky	673
" <i>alpina</i> L.	645	" <i>koraiensis</i> C. K. Schn.	662
" <i>alpina</i> Pall.	654	" <i>laetevirens</i> Kom.	641
" " var. <i>colchica</i> Kusn.	654	" <i>libanoticus</i>	654
" " <i>grandifolia</i> Dipp.	654	" <i>lycioides</i> Pall.	669
" <i>baldschuanica</i> Grub.	672	" <i>microcarpa</i> Boiss.	665
" <i>balearica</i> Willk.	653	" " var. <i>acutifolia</i>	Medw. 655
" <i>brevifolia</i> A. Br.	647	" " var. <i>acutifolia</i> (Medw.)	Grub. 656
" <i>cathartica</i> L.	660, 646	" " " <i>cordata</i> (Medw.)	Grub. 655
" " var. <i>caucasica</i> Kusn.	662	" " " <i>microphylla</i> Trautv.	655
" " " <i>seravschanica</i> Kom.	672	" <i>minuta</i> Grub.	673
" " " <i>spathulaefolia</i> Maxim.	670	" <i>myrtifolia</i> Willk.	653
" " " $\beta.$ <i>intermedia</i> Maxim.	659	" <i>nipponica</i> (Makino) Grub.	656
" " " $\gamma.$ <i>dahurica</i> Maxim.	659	" <i>oleoides</i> L.	647
" " " $\gamma.$ <i>coriacea</i> Rgl.	672	" <i>orbiculata</i> Bornm.	664
" " f. <i>longipetala</i> Grub.	661	" <i>Pallasii</i> B. Fedtsch.	671
" " " <i>pubescens</i> Lge.	661	" <i>Pallasii</i> Fisch. et Mey.	654, 669
" <i>cathartica</i> L.	647	" " ssp. $\beta.$ <i>spathulifolia</i>	Medw. 669
" <i>chlorophorus</i> Dene.	646	" " var. <i>spathulifolia</i> Schmalh.	670
" <i>Clusii</i> Willd.	653	" <i>palustris</i> L.	636
" <i>colchica</i> Somm. et Lev.	654	" <i>parvifolia</i> Bge.	663, 659
" <i>cordata</i> Medw.	655	" <i>parvifolia</i> Nakai	663
" <i>coriacea</i> (Rgl.) Kom.	671	" <i>parviflora</i> Kitag.	663
" " f. <i>lanceolata</i> Grub.	672	" <i>persicifolia</i> Moris	660
" <i>dahurica</i> Pall.	656	" <i>petiolaris</i> Boiss.	646, 664
" <i>dahurica</i> Rgl.	659	" <i>polymorpha</i> Turcz.	659, 663
" " var. <i>nipponica</i> Nakai	660	" <i>Potanini</i> J. Vass.	663
" <i>Dechenii</i> O. Web.	647	" <i>pseudogoldiana</i> Hollik	647
" <i>deleta</i> Heer	647	" <i>pumilis</i> Wulf.	644
" <i>depressa</i> Grub.	655	" " $\epsilon.$ <i>Wulfeni</i> DC.	644
" <i>diamantiaca</i> Nakai	662, 659	" <i>punctata</i> Heer	647
" <i>dolichophylla</i> N. Gontsch.	664		
" <i>duensis</i> Heer	647		
" <i>ecoaenica</i> Bors.	647		
" <i>Eridani</i> Ung.	647		
" <i>erythroxylon</i> M. B.	669		

Rhamnus	rectinervis Heer	647	Rhus	Toxicod. var. radicans auct.	535
"	cf. rectinervis Heer	648	"	" " volubilis Engl.	535
"	rumeliaca Friwald.	644	"	trichocarpa Miq.	538
"	rapestris C. A. M.	655	"	turcomanica (Krysht.) Vasil.	528
"	" Scop.	644	"	typhina Torner	530
"	sanguinea Pers.	642	"	velutina Wall.	527
"	saxatilis Jacq.	646	"	venenata DC.	538
"	" L.	646, 665	"	vernicifera DC.	537
"	" Fedtsch. et Fler.	665	"	verniciflua Stokes	537
"	" var. tinctoria (W. et K.)		"	Vernix L.	537, 538
	Hegi	665	"	sp.	528
"	Schneideri Lev.	662	Ricinoides	Moench	288
"	Sintenisii Rech. f.	671, 644	"	tinctoria Moench	290
"	songorica N. Gontsch.	673	Ricinus	L.	300
"	spathulifolia B. Fedtsch.	671	"	communis L.	300
"	spathulifolia Fisch. et Mey.	670	"	persicus Pop.	302
"	spinosa Gilib.	661	"	sanguineus Host.	302
"	Sukatschewii E. Wolf	662	"	zanzibarensis Hort.	300
"	tangutica J. Vass.	663	Robertiana	Bolss., sect.	35
"	tinctoria Waldst. et Kit.	646, 665	Robertianum	nostrum Goldb.	35
"	tortuosa Somm. et Lev.	669	Rotundifolia	Gams, sect.	51
"	transcaspica Grub.	671	Rubra	Pax, sect.	619
"	tripolitana Engl.	653	Rulac	Adans.	621
"	ussuriensis J. Vass.	659	"	negundo Kitch. et Robinson	621
"	utilis Decne.	646, 647, 656, 660	"	quercifolium Hollik	580
"	virgata var. sylvestris Maxim.	662	Ruta	L.	199
"	" β . aprica Maxim.	663	"	acatifolia DC.	226
"	Wulfeni Hoppe	644	"	affinis Aitch. et Hemsl.	212
"	Ziziphus L.	637	"	Besseri Nym.	208
Rhoideae	Engl.	518	"	Bungei B. Fedtsch.	222
Rhus	L.	527	"	dahurica DC.	205
Rhus	L., p.p.	526, 531	"	divaricata Siev.	226
"	cacodendron Ehrh.	242	"	graveolens L.	199
"	carolinianum Mill.	530	"	hirsuta O. Ktze.	206
"	coriaria L.	528	"	hortensis Mill.	199
"	" var. sumae Engl.	529	"	latifolia B. Fedtsch.	225
"	Cotinus L.	526	"	linifolia auct.	207
"	gigantea Pim.	528	"	montana L.	200
"	hirta (L.) Sudw.	530	"	obtusifolia Ldb.	214
"	javanica L.	531	"	parviflora Desf.	219
"	juglandogene Ett.	528	"	pedicellata Aitch. et Hemsl.	206
"	lanceolata Bors.	528	"	perforata M. B.	226
"	laevis Wall.	527	"	pilosa O. Ktze.	206
"	Merianii Heer	528	"	robusta B. Fedtsch.	223
"	orientalis C. K. Schn.	535	"	rotundifolia Aitch. et Hemsl.	224
"	quercifolia Goepp.	528	"	Sieversii B. Fedtsch.	226
"	radicans L.	535	"	suaveolens DC.	207 208
"	sachalinensis Krysht.	528	"	taurica Nym.	207
"	semialata Murr.	531	"	thesioides Fischer	207
"	sinensis Houttuyn	242	"	versicolor B. Fedtsch.	224
"	sumac Targ.	529	"	" var. leianthum Vved.	225
"	toxicodendron auct.	535	"	villosa M. B.	219
"	Toxicodendron L.	535	Rutaceae	Juss.	198.
"	" var. hispida Engl.	535			

Rutoideae Engl., subfam.	199	Striata Knuth, sect.	45
Saccharina Pax, sect.	612	Subacaulis Boiss., sect.	9
Sageretia Brongn.	638	Sumac (DC.) C. K. Schn., subgenus	528
„ <i>Brandrethiana</i> Aitch.	641	<i>Syllinum</i> Boiss. sect.	130
„ „ Boiss.	638	Sylvatica Knuth, sect.	14
„ <i>caucasica</i> Palib.	638	<i>Synema perenne</i> Dulac	296
„ <i>laetevirens</i> (Kom.) Gontsch.	638	Telephioides (Moench) Endl., sect.	271
„ <i>yemensis</i> (Defl.) Grub.	641	Tetradiclidoidae Engl., subfam.	150
Salpiglochilon Warb., sect.	633	Tetradiclis Stev.	151
Sanguinea Knuth, sect.	10	„ <i>Eversmanni</i> Bge.	151
Sapindaceae	623	„ <i>salsa</i> C. A. M.	151
Sapindus oassioides Ett.	623	„ <i>tenella</i> (Ehrenb.) Litw.	151
„ <i>defuncta</i> Heer	623	Tibeticae Prokh., subsect.	334, 737
„ <i>falcifolia</i> A. Br.	623	Tithymalus Boiss., sect.	309
„ <i>graeca</i> Ung.	623	„ Mill.	308
„ <i>Hæzslinskyi</i> Ett.	623	„ <i>Tourn.</i>	308, 309
„ <i>heliconia</i> Ung.	623	„ <i>acuminatus</i> (Lam.) Prokh.	465
„ cf. <i>oregoniana</i> Knowlt.	623	„ <i>agrarius</i> (M. B.) Kl. et Gke.	430
„ <i>radobojana</i> Ung.	623	„ <i>alaicus</i> Prokh.	388
„ <i>undulata</i> Heer	624	„ <i>alatavicus</i> (Boiss.) Prokh.	373
„ <i>Ungeri</i> Ett.	624	„ <i>aleppicus</i> (L.) Kl. et Gke.	460
<i>Sarcozygium</i> Bge.	184	„ <i>alpinus</i> (Ldb.) Kl. et Gke.	370
<i>Sarcozygium</i> (Bge.) Boriss., subgenus	184	„ <i>altaicus</i> (Ldb.) Kl. et Gke.	381
<i>Sarcozygium</i> Engl.	184	„ <i>amygdaloides</i> (L.) Garsault	456
<i>Schmaltzia hirta</i> Small	530	„ <i>andrachnoides</i> (Schrenk) Kl. et Gke.	418
<i>Sclerocyathium</i> Prokh.	336	„ <i>angulatus</i> (Jacq.) Rafin.	381
<i>Sclerocyathium</i> Prokh., sect.	336	„ <i>aristatus</i> (Schmalh.) Prokh.	361
„ <i>Popovii</i> Prokh.	336	„ <i>armenus</i> Prokh.	411
Securinea Comm.	282, 287	„ <i>arvalis</i> (Boiss. et Heldr.) Kl. et Gke.	472
„ <i>ramiflora</i> Müll.	283	„ <i>aserbajdzanicus</i> (Bordz.) Prokh.	470
„ <i>suffruticosa</i> (Pall.) Rehd.	283	„ <i>astrachanicus</i> (C. A. M. ex Claus) Prokh.	440
<i>Sexovulata</i> Boiss., 9	206	„ <i>Aucheri</i> (Boiss.) Kl. et Gke.	456
Sieboldianae Prokh., subsect.	451, 743	„ <i>aulacospermus</i> (Boiss.) Kl. et Gke.	464
Simarubaceae Lindl.	241	„ <i>biglandulosus</i> (Desf.) Haw.	405
Skimmia Thunb.	710	„ <i>blepharophyllus</i> (Ldb.) Kl. et Gke.	345
„ <i>japonica</i> Thunb.	710	„ <i>Boissierianus</i> Woron.	445
„ <i>repens</i> Nakai	710	„ <i>Borodini</i> (Sambuk) Prokh.	427
„ „ var. <i>typica</i> Mak.	710	„ <i>Borszczowii</i> Prokh.	425
<i>Spinovitis</i> Romanet	675	„ <i>buchtormensis</i> (Ldb.) Kl. et Gke.	371
Staphylea L.	578	„ <i>Buhsei</i> (Boiss.) Prokh.	419
„ <i>colchica</i> Stev.	578	„ <i>Bungei</i> (Boiss.) Prokh.	386
„ „ var. <i>Kochiana</i> Medw.	579	„ <i>carniolicus</i> (Jacq.) Rafin.	365
„ „ „ <i>lasianandra</i> Dipp.	579	„ <i>condylocarpus</i> (M. B.) Kl. et Gke.	377
„ „ f. <i>macrocarpa</i> Zbl.	559	„ <i>coniospermus</i> (Boiss. et Buhse) Prokh.	369
„ <i>Emodi</i> Wahl.	679		
„ <i>pinnata</i> L.	579		
„ <i>pinnatifida</i> Güld.	579		
„ <i>sarmatica</i> Krysh.	578		
„ sp.	578		
Staphyleaceae DC.	577		
<i>Staphylodendron</i> Scop.	578		
<i>Stellerolinum</i> Juz., sect.	125		

<i>Tithymalus consanguineus</i> (Schrenk) Kl.	
	et Gke. 471
" <i>cyparissias</i> (L.) Scop.	439
" <i>cyrtophyllus</i> Prokh.	441
" <i>deltobracteatus</i> Prokh.	457
" <i>densiusculus</i> (M. Pop.) Prokh.	475
" <i>densus</i> (Schrenk) Kl. et Gke.	473
" <i>denticulatus</i> (Lam.) Moench	412
" <i>discolor</i> (Ldb.) Kl. et Gke.	423
" <i>dulcis</i> (L.) Scop.	379
" <i>eriphorus</i> (Boiss.) Kl. et Gke.	382
" <i>Esula</i> (L.) Scop.	419
" <i>Eugeniae</i> Prokh.	356
" <i>exiguus</i> (L.) Lam.	460
" <i>felcatus</i> (L.) Kl. et Gke.	464
" <i>ferganensis</i> (B. Fedtsch.) Prokh.	346
" <i>Francheti</i> (B. Fedtsch.) Prokh.	467
" <i>Gerardianus</i> Steud.	396
" <i>graberrimus</i> (C. Koch) Kl. et	
	Gke. 454
" <i>glareosus</i> (Pall. ex M. B.)	
	Prokh. 402
" <i>glomerulans</i> Prokh.	429
" <i>Gmelini</i> Prokh.	422
" <i>Coldei</i> Prokh.	404
" <i>graecus</i> (Boiss. et Sprun.) Prokh.	461
" <i>Grossheimii</i> Prokh.	391
" <i>guntensis</i> Prokh.	442
" <i>helioscopius</i> (L.) Scop.	383
" <i>herpetorrhizus</i> Prokh.	457
" <i>humilis</i> (Ldb.) Kl. et Gke.	397
" <i>hypoleucus</i> Prokh.	445
" <i>ibericus</i> (Boiss.) Prokh.	435
" <i>indieriensis</i> (Less.) Kl. et Gke.	468
" <i>irgisensis</i> (Litw.) Prokh.	417
" <i>ispahanicus</i> (Boiss.) Kl. et Gke.	390
" <i>issykkulensis</i> Prokh.	386
" <i>jaxarticus</i> Prokh.	446
" <i>Karoi</i> (Freyn) Prokh.	424
" <i>Kamorovianus</i> Prokh.	343
" <i>kopetdaghi</i> Prokh.	393
" <i>Kudrjaschevii</i> (Pazij) Prokh.	352
" <i>lamprocarpus</i> Prokh.	363
" <i>lanatus</i> (Sieber) Prokh.	476
" <i>latifolius</i> (Ldb.) Kl. et Gke.	426
" <i>Lathyris</i> (L.) Scop.	479
" <i>Ledebourianus</i> Prokh.	341
" <i>Ledebourii</i> (Boiss.) Prokh.	462
" <i>leptocaulus</i> (Boiss.) Prokh.	443
" <i>Lipskyi</i> Prokh.	347
" <i>Litwinowii</i> Prokh.	457
" <i>lucidus</i> (W. et K.) Kl. et Gke.	434
" <i>lucorum</i> (Rupr.) Prokh.	374

<i>Tithymal. macrocarpus</i> (Boiss. et Buhse)	
	Prokh. 350
" <i>macroceras</i> (Fisch. et Mey.) Kl.	
	et Gke. 455
" <i>macrocladus</i> (Boiss.) Prokh.	400
" <i>macrorrhizus</i> (Ldb.) Kl. et Gke.	371
" <i>Marshallianus</i> auct.	406
" " (Boiss.) Kl. et Gke.	410
" <i>microcarpus</i> Prokh.	421
" <i>microsphaerus</i> (Boiss.) Kl. et	
	Gke. 368
" <i>mongolicus</i> Prokh.	342
" <i>monocyathium</i> Prokh.	338
" <i>monostylus</i> Prokh.	406
" <i>mucronulatus</i> Prokh.	351
" <i>Myrsinites</i> (L.) Hill.	408
" <i>Normanni</i> (Schmalh.) Prokh.	466
" <i>oblongifolius</i> (C. Koch) Kl. et	
	Gke. 455
" <i>orientalis</i> (L.) Hill.	352
" <i>pachyrrhizus</i> (Kar. et Kir.) Kl.	
	et Gke. 378
" <i>Pallasii</i> (Turcz.) Kl. et Gke.	343
" <i>paluster</i> (L.) Garsault	355
" <i>pamiricus</i> Prokh.	438
" <i>paralias</i> (L.) Scop.	391
" <i>pectinatus</i>	408
" <i>Peplus</i> (L.) Gaertn.	463
" <i>pilosus</i> (L.) Scop.	364
" <i>platyphyllos</i> (L.) Rafin.	367
" <i>poecilophyllus</i> Prokh.	428
" <i>polychromus</i> (Kern.) Prokh.	364
" <i>polytimeticus</i> Prokh.	458
" <i>ponticus</i> Prokh.	408
" <i>pseudagrarius</i> (P. Smirn.)	
	Prokh. 436
" <i>pseudosororius</i> Prokh.	470
" <i>pubescens</i> (Vahl) Prokh.	372
" <i>pygmaeus</i> Kl. et Gke.	468
" <i>rapulum</i> (Kar. et Kir.) Kl. et	
	Gke. 344
" <i>rupester</i> Kl. et Gke.	341
" <i>salicifolius</i> (Host) Kl. et Gke.	429
" <i>sareptanus</i> (A. Beck.) Prokh.	426
" <i>Savaryi</i> (Kiss.) Prokh.	452
" <i>schugnanicus</i> (B. Fedtsch.)	
	Prokh. 387
" <i>sclerocyathium</i> (E. Kor. et M.	
	Pop.) Prokh. 336
" <i>scriptus</i> (Somm. et Lev.) Prokh.	348
" <i>Seguierianus</i> (Neck.) Prokh.	396
" <i>semivillosus</i> Prokh.	360
" <i>serawschanicus</i> (Rgl.) Prokh.	338

<i>Tithymalus sewerzowii</i> (Herd.) Prokh. . . 433	<i>Toxicodendron vernicifluum</i> (Stokes) Linz. 537
„ <i>Sieboldianus</i> (Morr. et Decne.) Prokh. 451	„ <i>vernix</i> (L.) Ktze. 538
„ <i>sogdianus</i> (M. Pop.) Prokh. . 399	Tribulus L. 149
„ <i>soongaricus</i> (Boiss.) Prokh. . 362	„ <i>bicornutus</i> Fisch. et Mey. . . . 195
„ <i>sororiū</i> s (Schrenk) Kl. et Gke. 470	„ <i>macropterus</i> Boiss. 194
„ <i>spinidens</i> Prokh. 407	„ <i>persicus</i> Kralik 195
„ <i>squamosus</i> (Willd.) Kl. et Gke. 349	„ <i>terrestris</i> L. 195
„ <i>stepposus</i> (Zoz) Prokh. . . . 401	„ <i>uniflorus</i> Nevski 195
„ <i>strictus</i> (L.) Kl. et Gke. . . . 366	<i>Tricera</i> Baill., sect. 505
„ <i>subcordatus</i> (Ldb.) Kl. et Gke. 448	<i>Trichocarpa</i> Prain, sect. 289
„ <i>subtilis</i> Prokh. 421	<i>Trifoliata</i> (Pax) Koidz., sect. . . . 617
„ <i>Szovitsii</i> (Fisch. et Mey.) Kl. et Gke. 474	<i>Trifoliatae</i> sect. <i>Acetosella</i> Reiche, div. 79
„ <i>talastavicus</i> Prokh. 379	„ „ <i>Corniculatae</i> Reiche, div. 77
„ <i>tauricola</i> Prokh. 358	<i>Trilobata</i> Pojark., sect. 601
„ <i>tianschanicus</i> Prokh. 339	<i>Trimorpha</i> Alef. 110
„ <i>tibeticus</i> (Boiss.) Prokh. . . . 385	<i>Tropaeolaceae</i> Juss. 83
„ <i>transoxanus</i> Prokh. 350	Tropaeolum L. 84
„ <i>Tranzschelii</i> Prokh. 386	„ major L. 84
„ <i>triodontus</i> Prokh. 469	„ minus L. 84
„ <i>tshuiensis</i> Prokh. 440	<i>Tuberosa</i> Boiss., sect. 60
„ <i>Turczaninowii</i> (Kar. et Kir.) Kl. et Gke. 472	<i>Tulocarpa</i> Prokh., sect. 348, 383
„ <i>turkestanicus</i> (Rgl.) Prokh. . 388	„ Rafin., subgenus 348
„ <i>undulatus</i> (M. B.) Kl. et Gke. 414	<i>Tulocarpa</i> (Rafin.) Prokh., sect. . . . 347
„ <i>uralensis</i> (Fisch. et Link) Prokh. 437	<i>Tuloisia</i> Rafin., subgenus 348
„ <i>villosus</i> (Waldst. et Kit.) Paster 359	<i>Turibana</i> Nakai, subgenus 576
„ <i>virgatus</i> (W. et K.) Kl. et Gke. 444	<i>Unguiculata</i> Boiss., sect. 34
„ <i>volgensis</i> (Krysht.) Prokh. . 403	<i>Uniloculares</i> Rouy et Foucaud, sect. . . 566
„ <i>Witmanni</i> (Boiss.) Prokh. . . 377	<i>Vernix</i> (Adans.) C. K. Schn., sect. . . . 537
„ <i>zhiguliensis</i> Prokh. 447	<i>Virgatifformes</i> Grub., subsect. 662
<i>Toddalioideae</i> Engler, subfam. 232	<i>Vitaceae</i> Lindl. 674
<i>Tournesol</i> Adans. 288	<i>Vitiphyllum</i> cf. <i>Naumannii</i> Nath. 677
<i>Tournesolia</i> Scop. 288	Vitis L. 675
„ <i>gracilis</i> O. Ktze. 290	„ <i>aegirophylla</i> Boiss. 704, 705
„ <i>tinctoria</i> Baill. 290	„ <i>aestivalis cordifolia</i> 679
„ <i>verbascifolia</i> O. Ktze. . . . 295	„ <i>alaskana</i> Cock. 677
Toxicodendron Mill. 531	„ <i>alemanica</i> Andras. 696
„ <i>altissimum</i> Mill. 242	„ <i>amurensis</i> Rupr. 700
„ <i>diversiloba</i> (Torr. et Gray) Greene 536	„ „ <i>× Kaempferi</i> 704
„ <i>orientale</i> Greene 535	„ <i>antiquorum</i> Andras. 696
„ <i>quercifolia</i> (Michx.) Grene 536	„ cf. <i>arctica</i> Heer 677
„ <i>radicans</i> (L.) Ktze. 535	„ <i>Berlandieri</i> Planch. 683
„ <i>succedana</i> (L.) Ktze. 538, 539	„ „ <i>× V. riparia</i> 683
„ <i>trichocarpum</i> (Miq.) Ktze. 538	„ „ <i>× V. vinifera</i> 683
„ <i>vernicifera</i> C. A. et F. A. Barkley 537	„ <i>bosturgaiensis</i> Vass. 696
	„ <i>brevipedunculata</i> Dipp. 705
	„ <i>byzantina</i> Andras. 695
	„ <i>cordata</i> C. Koch 705
	„ <i>crenata</i> Heer 677
	„ <i>deliciosa</i> Andras. 696
	„ <i>hederacea</i> Ehrh. 709

<i>Vitis hederacea</i> Huot.	697
„ <i>heterophylla</i> Thunb.	706
„ „ var. <i>α. cordata</i> Rgl.	705
„ <i>hissarica</i> Vass.	697
„ <i>hyrcanica</i> Vass.	680, 696
„ <i>incisa</i> Jacq.	685
„ <i>inconstans</i> Miq.	708
„ <i>labrusca</i> L.	678
„ „ <i>c. ficifolia</i> Rgl.	680
„ „ <i>d. sinuata</i> Rgl.	680
„ <i>lapilloides</i> Vass.	697
„ <i>macrophylla</i> Baik.	677
„ <i>mediterranea</i> Andras.	695
„ <i>monticola</i> Planch.	683
„ <i>Nathorstii</i> Krysh.	677
„ <i>odoratissima</i> Donn.	685
„ <i>persica</i> Boiss.	705
„ <i>pistacioides</i> Vass.	696
„ <i>prævinifera</i> Sap.	677
„ <i>pulchra</i> Rehd.	704
„ <i>quinquefolia</i> Lam.	709
„ <i>riparia</i>	685
„ <i>rupestris</i> Scheele	684
„ <i>sachalinensis</i> Krysh.	677
„ <i>Schischkinii</i> Vass.	697
„ <i>serjanaefolia</i> Franch. et Sav.	706
„ <i>silvestris</i> Gmel.	697
„ „ var. <i>dzharylgatschensis</i> Vass.	699
„ <i>subacertifolia</i> Vass.	697
„ <i>sylvestris</i> Gmel.	696
„ <i>tanghimuri</i> Vass.	697
„ <i>taurica</i> Vass.	696, 699
„ <i>teutonica</i> A. Br.	677
„ cf. <i>teutonica</i> A. Br.	677
„ <i>Thunbergii</i> Rgl.	700
„ <i>Thunbergii</i> Sieb. et Zucc.	680
„ <i>trichophylla</i> (Kolen.) Vass.	696
„ <i>usunachmatica</i> Vass.	696
„ <i>vicifolia</i> Bge.	680
„ <i>vinifera</i> auct.	697
„ <i>vinifera</i> L.	679
„ „ ssp. <i>sativa</i> (DC.) Hegi	686
„ „ „ <i>sativa</i> (DC.) Rgl.	695
„ „ „ <i>silvestris</i> Beck	697
„ „ „ <i>sylvestris</i> (Gmel.) Rgl.	695
„ „ „ <i>trichophylla</i> Kolen.	696
„ „ „ <i>laciniosa</i> (L.) Asch.	686
„ „ „ <i>α. sylvestris</i> DC.	697
„ „ „ <i>β. amurensis</i> Rgl.	700
„ „ „ <i>σ. Labrusca</i> var. <i>americana</i> O. Ktze.	678
„ „ „ „ <i>orientalis</i> O. Ktze.	678, 679

<i>Vitis</i> vin. <i>σ. Labr.</i> var. <i>silvestris</i> (Döll.) O. Ktze.	697
„ „ „ „ <i>I. Thunbergii</i> O. Ktze.	680
„ <i>vinifera aneophylla</i> Kolenati	697
„ „ <i>silvestris</i> Doell.	697
„ „ <i>spontanea</i> M. Pop.	686
„ „ <i>trichophylla</i> Kolenati	697
„ <i>vulpina</i> L.	685
„ „ <i>α. amurensis</i> Rgl.	700
<i>Vitoideae</i> Gilg, subfam.	675
<i>Vulgares</i> Chod.	256
<i>Xantholinum flavum</i> Rehb.	136
<i>Xanthoxylon</i> Boriss., sect.	184, 728
<i>Xylophila ramiflora</i> Ait.	283
<i>Zizypheae</i> Benth. et Hook., tribus	635
Zizyphus Mill.	636
„ <i>affinis</i> Lesq.	637
„ <i>cinnamomoides</i> Lesq.	637
„ <i>fibrillosa</i> Lesq.	637
„ <i>fothergilloides</i> Krysh.	637
„ <i>hyperborea</i> Heer	637
„ <i>jujuba</i> Mill.	637
„ „ var. <i>inermis</i> Bge.	637
„ <i>kolymensis</i> Krysh.	637
„ <i>matutina</i> Krysh.	637
„ <i>Paliurus</i> Willd.	636
„ <i>phorophoria</i> Krysh.	637
„ <i>sachalinensis</i> Krysh.	637
„ <i>sativa</i> Gaertn.	637
„ <i>sinensis</i> Lam.	637
„ <i>tiliaefolia</i> (Ung.) Heer	63
„ <i>vulgaris</i> Lam.	637
„ sp.	637
<i>Zygophyllaceae</i> Lindl.	146
<i>Zygophylloideae</i> Engl., subfam.	152
Zygophyllum L.	152
„ <i>altaicum</i> Steph.	177
„ <i>atriplicoides</i> auct.	190, 192
„ <i>atriplicoides</i> Fisch.	191
„ „ ssp. <i>euryptherum</i> M. Pop.	189
„ „ „ <i>typicum</i> M. Pop.	191
„ „ var. <i>tetramerum</i> M. Pop.	191
„ <i>balchaschense</i> Boriss.	171, 724
„ <i>brachypterum</i> Kar. et Kir.	165
„ <i>bucharicum</i> B. Fedtsch.	188
„ „ var. <i>albiflorum</i> Boriss.	189

<i>Zygophyllum cinnabarinum</i> Freyn	166	<i>Zygophyllum macropodum</i> Boriss. . .	161, 724
" <i>coccineum</i> Schrenk	182	" <i>macropterum</i> C. A. M. . .	182
" <i>cuspidatum</i> Boriss. . . .	174, 726	" " var. <i>micro-</i>	
" <i>darvasicum</i> Boriss. . . .	190, 729	" <i>phylla</i> Boriss. . .	183
" <i>Dielsianum</i> M. Pop. . . .	169	" <i>megacarpum</i> Boriss. . .	192, 730
" <i>dumosum</i> Boiss.	189	" <i>melongena</i> Bge.	193
" <i>Eichwaldii</i> C. A. M. . .	179, 180	" <i>microcarpum</i> Boriss. . .	168, 724
" " var. α . Bge. . .	170	" <i>miniatum</i> Cham et	
" " " β . <i>strictior</i>		" Schlecht. . .	166
" Bge. . .	180	" " ssp. <i>Dielsianum</i>	
" <i>Eichwaldii</i> M. Pop. . . .	180	" M. Pop. . .	169
" <i>enrypterum</i> Boiss. et Buhse	189	" " var. <i>cinnabarinum</i>	
" <i>fabago</i> auct.	160, 161	" Fr. et Sint. . .	166
" " Kryl.	165	" " <i>Englerianum</i>	
" <i>fabago</i> L.	159	" M. Pop. . .	166
" " ssp. <i>brachypterum</i>		" <i>inucronatum</i> Maxim. . . .	174
" M. Pop. . .	165	" " M. Pop. p. p. . .	174
" " " <i>dolichocarpum</i>		" <i>obliquum</i> M. Pop. p. p. .	161 192
" M. Pop. . .	160	" <i>ovigerum</i> Fisch. et Mey. .	180
" " " <i>orientale</i> Bo-		" <i>oxianum</i> Boriss.	160, 723
" riss. . .	160	" <i>oxycarpum</i> M. Pop. . .	172
" " " <i>typicum</i> M. Pop. .	160	" <i>pinnatum</i> Cham. et	
" var. <i>brachypterum</i>		" Schlecht. . .	182
" M. Pop. . .	159	" <i>portulacoides</i> Cham. . . .	158
" <i>fabagoides</i> M. Pop. . . .	178	" <i>Potaninii</i> Maxim.	183
" <i>ferganense</i> (Drob.) Boriss. .	184	" <i>pterocarpum</i> Bge.	177
" " ssp. <i>elongatum</i>		" <i>ramosissimum</i> M. Pop. . .	179
" Boriss. . .	187	" <i>Rosovii</i> Bge.	167
" <i>furcatum</i> C. A. M.	172	" " var. <i>latifolium</i>	
" <i>gobicum</i> Maxim.	183	" (Schrenk) M. Pop. . .	167
" <i>Gontscharovii</i> Boriss. . .	190, 729	" <i>Sieversianum</i> Steph. . . .	182
" <i>iliense</i> M. Pop.	176	" <i>stenopterum</i> Schrenk . .	181
" <i>karatavicum</i> Boriss. . .	174, 726	" <i>subtrijugum</i> C. A. M. . .	170
" <i>Karelini</i> F. et M.	175	" <i>taldy-kurganicum</i> Boriss. .	177, 727
" <i>kaschgaricum</i> Boriss. . .	187, 728	" <i>trijugum</i> Meyer	170
" <i>kegenense</i> Boriss. . . .	181, 727	" <i>tueromanicum</i> Fisch. et Mey.	168
" <i>kopalense</i> Boriss. . . .	173, 726	" <i>xanthoxylon</i> auct. p. p. .	187
" <i>latifolium</i> Schrenk	167	" " Maxim.	187, 188
" <i>Lehmannianum</i> Bge . . .	175	" " ssp. <i>ferganense</i>	
" <i>macrophyllum</i> Rgl. et		" M. Pop . .	184
" Schmalh. . .	158	" " var. <i>ferganense</i>	
		" Drob. . .	184

VEGETATION REGIONS OF THE USSR

Abbreviated name	Full name
I. Arctic	
1. Arc.Eur.	Arctic (European part)
2. Nov.Z.	Novaya Zemlya
3. Arc.Sib.	Arctic (Siberia)
4. Chuk	Chukchi
5. An.	Anadyr
II. European part	
6. Kar.-Lap.	Karelia-Lapland
7. Dv.-Pech.	Dvina-Pechora
8. Balt.	Baltic States
9. Lad.-Il'm.	Ladoga-Il'men
10. U.V.	Upper Volga
11. V.-Kama	Volga-Kama
12. U.Dnp.	Upper Dnieper
13. M.Dnp.	Middle Dnieper
14. V.-Don.	Volga-Don
15. Transv.	Transvolga area
16. U.Dns.	Upper Dniester
17. Bes.	Bessarabia
18. Bl.	Black Sea area
19. Crim.	Crimea
20. L.Don	Lower Don
21. L.V.	Lower Volga
III. Caucasus	
22. Cisc.	Ciscaucasia
23. Dag.	Dagestan
24. W. Transc.	Western Transcaucasia
25. E. Transc.	Eastern Transcaucasia
26. S. Transc.	Southern Transcaucasia
27. Tal.	Talysh
IV. West Siberia	
28. Ob	Ob region (from the eastern slopes of the Urals to the Yenisei River)
29. U.Tob.	Upper Tobol
30. Irt.	Irtysk
31. Alt.	Altai

- | | | |
|------|-------------------------|----------------------------------|
| V. | East Siberia | |
| | 32. Yenisei | Yenisei |
| | 33. Lena-Kol. | Lena-Kolyma |
| | 34. Ang.-Say. | Angara River-Sayans |
| | 35. Dau. | Dauria |
| VI. | Far East | |
| | 36. Kamch. | Kamchatka |
| | 37. Okh. | Okhotsk |
| | 38. Ze.-Bu. | Zeya-Bureya |
| | 39. Uda. | Udar River area |
| | 40. Uss. | Ussuri |
| | 41. Sakh. | Sakhalin |
| VII. | Soviet Central Asia | |
| | 42. Ar.-Casp. | Aral-Caspian |
| | 43. Balkh. | Lake Balkhash area |
| | 44. Dzu.-Tarb. | Dzungaria-Tarbagatai |
| | 45. Kyz.K. | Kyzyl-Kum |
| | 46. Kara K. | Kara-Kum |
| | 47. Mtn. Turkm. | Mountainous part of Turkmenistan |
| | 48. Amu D. | Amu Darya |
| | 49. Syr D. | Syr Darya |
| | 50. Pam.-Al. | Pamir-Alai |
| | 51. T. Sh. | Tien Shan |

Accepted Regions for Indication of General Distribution of
Species Appearing in "Flora of the U. S. S. R."

- | | | |
|-------|-----------------------|---|
| I. | Arc. | Arctic (Spitsbergen, Greenland and farther) |
| II. | Scand. | Scandinavia (Norway, Denmark, Sweden, Finland) |
| III. | Centr. Eur. | Central Europe (Germany, Poland, Czechoslovakia, Hungary, Austria, Switzerland) |
| IV. | Atl. Eur. | Atlantic Europe (Netherlands, Belgium, Britain, France, Portugal) |
| V. | Med. | Mediterranean (including North Africa) |
| VI. | Bal.-As. Min. | Balkan Peninsula and Asia Minor |
| VII. | Arm.-Kurd. | Lesser Armenia and Kurdistan |
| VIII. | Iran | Iran and Afghanistan |
| IX. | Ind.-Him. | India and Himalayas |
| X. | Dzu.-Kash. | [Dzungaria-Kashgar area] Eastern or Chinese Turkestan (Sinkiang) |
| XI. | Mong. | Mongolia |
| XII. | Jap.-Ch. | Japan and China |
| XIII. | Ber. | North American coast of the Bering Sea |
| XIV. | N. Am. | North America (U. S. A. and Canada) |
| XV. | Tib. | Tibet |

Other Geographical Abbreviations

Afr.	Africa
Aust.	Australia
Centr.	Central
E.	East(ern)
Gr.	Great, Greater
I.	Island
Is.	Islands
Mt.	Mount
Mts.	Mountains
N.	North(ern)
R.	River
S.	South(ern)
W.	West(ern)

TRANSLATOR'S NOTE

1. The Russian term "Srednyaya Aziya" is, in English, Central Asia (or Soviet Central Asia). Therefore the term Middle Asia has been used for Russian "Tsentral'naya Aziya," which is non-Soviet inner Asia, comprising western China (Sinkiang and Tibet) and Mongolia.

2. According to Russian usage, the European part of the USSR is "eastern Europe." Therefore "western Europe" includes the whole of Europe outside the USSR.

EXPLANATORY LIST OF ABBREVIATIONS OF
RUSSIAN INSTITUTIONS AND PERIODICALS
APPEARING IN THE TEXT

Abbreviation	Full name (transliterated)	Translation
Bot.-Geogr. issled. v Turkest.	Botaniko-geograficheskie issledovaniya v Turkestane	Botanical and Geographical Investigations in Turkestan
Bot. Mat. Gerb. Bot. inst. AN SSSR	Botanicheskie Materialy Gerbariya Botaniche- skogo instituta AN SSSR	Botanical Materials of the Herbarium of the Botanical Institute of the Academy of Sciences of the USSR
Bot. Mat. Gerb. Gl. Bot. Sada	Botanicheskie Materialy Gerbariya Glavnogo Botanicheskogo Sada	Botanical Materials of the Herbarium of the Main Botanical Gardens
Bot. zap. SPb. univ.	Botanicheskie zapiski Sankt-Peterburgskogo universiteta	Botanical Notes of St. Petersburg University
Bot. zhurn. SSSR	Botanicheskii zhurnal SSSR	Botanical Journal of the USSR
Byull. Glavn. Bot. Sada	Byulleten' Glavnogo Botanicheskogo Sada	Bulletin of the Main Botani- cal Gardens
Byull. Obshch. lyubit. estest- vozn., antrop. i etnogr.	Byulleten' Obshchestva lyubitelei estestvoz- naniya, antropologii i etnografii	Bulletin of the Naturalists', Anthropologists' and Ethnographers' Society
Byull. Voronezh. obshch. estestv.	Byulleten' Voronezh- skogo obshchestva estestvoispytatelei	Bulletin of the Voronezh Society of Naturalists
Dendr.	Dendarii	Arboretum
Der. i kust.	Derev'ya i kustarniki	Trees and Shrubs
Der. i kust. Kavk.	Derev'ya i kustarniki Kavkaza	Trees and Shrubs of the Caucasus
Dikie polezn. i tekhnich. rasteniya SSSR	Dikie poleznye i tekhnicheskie rasteniya SSSR	Useful Wild Plants and Industrial Crops of the USSR
Dikorastushchie r. Kavkaza, ikh rasprostranenie, svoistva i primenenie	Dikorastushchie raste- niya Kavkaza, ikh rasprostranenie, svoistva i primenenie	Wild Plants of the Caucasus, Their Distribution, Properties and Uses

Dokl. AN Azerb. SSR	Doklady Akademii Nauk Azerbaidzhanskoi SSR	Reports of the Academy of Sciences of the Azerbaijan SSR
Fl.	Flora	Flora
Fl. Abkh.	Flora Abkhazii	Abkhasian Flora
Fl. Almat. Zapovedn.	Flora Alma-Atinskogo Zapovednika	Flora of the Alma-Ata Reserve
Fl. Alt.	Flora Altaya	Altai Flora
Fl. Alt. i Tomsk. gub.	Flora Altaiskoi i Tomskoi gubernii	Flora of Altai and Tomsk Provinces
Fl. Az. Ross.	Flora Aziatskoi Rossii	Flora of Asiatic Russia
Fl. Evrop. Rossii	Flora Evropeiskoi Rossii	Flora of European Russia
Fl. Gruzii	Flora Gruzii	Georgian Flora
Fl. Kamch.	Flora Kamchatki	Kamchatkan Flora
Fl. Kavk.	Flora Kavkaza	Caucasian Flora
Fl. Man'chzh.	Flora Man'chzhurii	Manchurian Flora
Fl. Mosk. gub.	Flora Moskovskoi gubernii	Flora of Moscow Province
Fl. Poles'ya	Flora Poles'ya	Flora of Polesie
Fl. Sev. Kraya	Flora Severnogo Kraya	Flora of the Northern Territory
Fl. Sakh.	Flora Sakhalina	Flora of Sakhalin
Fl. Sib.	Flora Sibiri	Siberian Flora
Fl. Sib. i Dal'n. Vost.	Flora Sibiri i Dal'nego Vostoka	Flora of Siberia and the Far East
Fl. Sr. i Yuzhn. Ross.	Flora Srednei i Yuzhnoi Rossii	Flora of Central and Southern Russia
Fl. Sr. Ross.	Flora Srednei Rossii	Flora of Central Russia
Fl. Tadzhik.	Flora Tadzhikistana	Flora of Tadzhikistan
Fl. Talysh.	Flora Talysha	Talysh Flora
Fl. Tsentr. Kazakhst.	Flora Tsentral'nogo Kazakhstana	Flora of Central Kazakhstan
Fl. Vost. Evr. Ross.	Flora Vostochnoi Evropeiskoi Rossii	Flora of East European Russia
Fl. Yugo-Vost.	Flora Yugo-Vostoka	Flora of the Southeast
Fl. Yugo-zap. Ross.	Flora Yugo-zapadnoi Rossii	Flora of Southwest Russia
Fl. Yur. Bot. sada	Flora Yur'evskogo botanicheskogo sada	Flora of Yur'ev Botanical Garden
Fl. Zap. Sib.	Flora Zapadnoi Sibiri	Flora of West Siberia
Gerb. donsk. fl.	Gerbarii donskoi flory	Herbarium of Don Flora
Gerb. Orlovsk. gub.	Gerbarii Orlovskoi gubernii	Herbarium of Orel Province
Gerb. Ukr. fl.	Gerbarii Ukrainskoi flory	Herbarium of Ukrainian Flora
GRF	Gerbarii Russkoi flory	Herbarium of Russian Flora
Ill. Fl. Mosk. gub.	Illyustrirovannaya Flora Moskovskoi gubernii	Illustrated Flora of Moscow Province
Izv. AN SSSR	Izvestiya AN SSSR	Bulletin of the Academy of Sciences of the USSR
Izv. Bot. Sada	Izvestiya Botanicheskogo Sada	Bulletin of the Botanical Gardens

Izv. Bot. Sada Petra Vel.	Izvestiya Botanicheskogo Sada Petra Velikogo	Bulletin of Peter the Great Botanical Gardens
Izv. Gl. Bot. Sada	Izvestiya Glavnogo Bota- nicheskogo Sada	Bulletin of the Main Botanical Gardens
Izv. Kavk. Muzeya	Izvestiya Kavkazskogo Muzeya	Bulletin of the Caucasian Museum
Izv. Kazakhst. fil. AN SSSR	Izvestiya Kazakhstan- skogo Filiala Akademii Nauk SSSR	Bulletin of the Kazakhstan Branch of the Academy of Sciences of the USSR
Izv. Kievsk. Bot. Sada	Izvestiya Kievskogo Botanicheskogo Sada	Bulletin of the Kiev Botani- cal Gardens
Izv. Obshch. lyubit. estest- vozn., antrop. i etnogr.	Izvestiya Obshchestva lyubitelei estestvoznaniya, antropologii i etnografii	Bulletin of the Naturalists', Anthropologists' and Ethnographers' Society
Izv. Obshch. Sadov.	Izvestiya Obshchestva Sadovodov	Bulletin of the Horticul- turists' Society
Izv. Tadzhik. Bazy AN SSSR	Izvestiya Tadzhikskoi Bazy Akademii Nauk SSSR	Bulletin of the Tadzhikistan Base of the Academy of Sciences of the USSR
Konsp. rast. okr. Khar'kova	Konspekt rastenii okruga Khar'kova	Compendium of Plants of Kharkov District
Korm. rast. Estestv. senoko- sov i pastb. SSSR	Kormovye rasteniya estestvennykh senoko- sov i pastbishch SSSR	Fodder Plants of Natural Hay Meadows and Pastures of the USSR
Mat. (dlya) Fl. Kavk.	Materialy dlya Flory Kavkaza	Material on Caucasian Flora
Mat. (dlya) fl. Sredn. Azii	Materialy dlya flory Srednei Azii	Materials on Soviet Central Asian Flora
Mat. (dlya) Fl. stepei Khers- sonsk. Gub.	Materialy dlya Flory stepei Khersonskoi Gubernii	Materials on the Flora of Kherson Province Steppes
Nov. obozr.	Novoe obozrenie	New Review
Ob. rast. Kievsk. uch. okr.	Obzor rastitel'nosti Kievskogo uchebnogo okruga	Survey of Vegetation in the Kiev Educational District
Obz. Krym.-Kavk. Medic ago	Obzor Krymsko- Kavkazskogo Medic ago	Survey of Crimean- Caucasian Medic ago
Och. obozr. i fl. Karpāt	Ocherki rastitel'nosti i flory Karpāt	Survey of Carpathian Vegetation and Flora
Ocherk. Tifl. fl.	Ocherki Tiflisskoi flory	Survey of Tiflis [Tbilisi] Flora
Opis. Amur. obl.	Opisanie Amurskoi oblasti	Description of the Amur Region
Opis. ist. razv. fl. vost. Tyan'- Shanya	Opisanie istorii razvi- tiya flory vostochnogo Tyan'-Shanya	Description of the History of the Development of Flora of the Eastern Tien Shan
Opis. nov. rast. Turk.	Opisanie novykh rastenii Turkeстана	Description of New Plants of Turkestan

Opis. nov. vidov	Opisanie novykh vidov	Description of New Species
Opred. der. i kust.	Opredelitel' derev'ev i kustarnikov	Key to Trees and Shrubs
Opred. rast. Dal'nevost. kr.	Opredelitel' rastenii Dal'nevostochnogo kraya	Key to Plants of the Far Eastern Territory
Opred. rast. Kavk.	Opredelitel' rastenii Kavkaza	Key to Caucasian Plants
Opred. vyssh.	Opredelitel' vysshikh rastenii	Key to Higher Plants
Opred. (vyssh.) rasten. Evrop. chasti SSSR	Opredelitel' (vysshikh) rastenii Evropeiskoi chasti SSSR	Key to Higher Plants of the European USSR
Opyt Russko- Kavk. Fl.	Opyt Russko-Kavkazskoi Flory	Attempted Russian- Caucasian Flora
Perech. rast. Turk.	Perechen' rastenii Turkmenii	List of Turkmenian Plants
Poch. eksped. v bass. r. Syr- Dar'i i Amu- Dar'i	Pochvennaya ekspedi- tsiya v basseinu rek Syr-Dar'i i Amu- Dar'i	Soil Science Expedition to the Syr-Darya and Amu- Darya River Basins
Priroda	Priroda	Nature
Protok. Zased. Kievsk. Obshch. Estestv.	Protokol Zasedaniya Kievskogo Obshchest- va Estestvoispytatelei	Protocol of a Conference of Kiev Naturalists' Society
Putesh.	Puteshestviya	Travels
Rast. i fl. Karp.	Rasteniya i flora Karpat	Plants and Flora of the Carpathians
Rast. letn. pastb. Gandzh.	Rasteniya letnikh past- bishch Gandzhi	Vegetation of Gandzha [now Kirovabad] Summer Pastures
Rast. res. Turkm.	Rastitel'nye resursy Turkmenii	Plant Resources of Turkmenia
Rast. resursy Kavkaza	Rastitel'nye resursy Kavkaza	Plant Resources of the Caucasus
Rast. Sib.	Rastitel'nost' Sibiri	Vegetation of Siberia
Rast. Sr. Az.	Rastitel'nost' Srednei Azii	Vegetation of Soviet Central Asia
Rast. Turkest.	Rastitel'nost' Turke- stana	Vegetation of Turkestan
Rast. Zakasp. obl.	Rastitel'nost' Zakaspi- skoi oblasti	Vegetation of the Trans- caspian Region
Rastit. Kavk.	Rastitel'nost' Kavkaza	Vegetation of the Caucasus
Rastit. pokrov. vost. Pamira	Rastitel'nyi pokrov vostochnogo Pamira	Plant Cover of the Eastern Pamirs
Rastit. syr'e Kazakhst.	Rastitel'noe syr'e Kazakhstana	Plant Resources of Kazakhstan
Rastit. zapovedn. Guralash i Zaaminsk. lesn. ugodii	Rastitel'nost' zapoved- nika Guralash i Zaaminskikh les- nykh ugodii	Vegetation of Guralash Reserve and Zaamin Forest Lands

Result. dvukh puteshestv. na Kavk.	Rezul'taty dvukh puteshestvii na Kavkaz	Results of Two Travels to the Caucasus
Russk. Fl.	Russkaya Flora	Russian Flora
Russk. lek. rast.	Russkie lekarstvennye rasteniya	Russian Medicinal Plants
Sbor, sushka i raz. lek. rast.	Sbor, sushka i razvitie lekarstvennykh rastenii	Gathering, Drying and Development of Medi- cinal Plants
Sorn. rast. SSSR	Sornye rasteniya SSSR	Weed Plants of the USSR
Sots. Rastenie- vodstvo	Sotsialisticheskoe Rastenievodstvo	Socialist Plant Growing
Sov. Bot.	Sovetskaya Botanika	Soviet Botany
Sov. Farmats.	Sovetskaya Farma- tsevtika	Soviet Pharmaceutics
Spis. rast.	Spisok rastenii	List of Plants
Spis. Rast. Krymsk. Zapovedn.	Spisok Rastenii Krymskogo Zapovednika	List of Plants of the Crimean Reserve
Tr. Bot. inst. AN SSSR	Trudy Botanicheskogo instituta AN SSSR	Transactions of the Botanical Institute of the Academy of Sciences of the USSR
Tr. Bot. Inst. Azerb. Filiala Akad. Nauk	Trudy Botanicheskogo Instituta Azerbaid- zhanskogo Filiala Akademii Nauk	Transactions of the Botani- cal Institute of Azerbaijan Branch of the Academy of Sciences
Tr. Bot. Sada	Trudy Botanicheskogo Sada	Transactions of the Botani- cal Gardens
Tr. Bot. Sada Yur'evsk. Univ.	Trudy Botanicheskogo Sada Yur'evskogo Universiteta	Transactions of the Botani- cal Gardens of Yur'ev [now Tartu] University
Tr. Byuro prikl. Bot.	Trudy Byuro po prik- ladnoi botanike	Transactions of the Bureau of Applied Botany
Tr. Dal'nevost. bazy AN SSSR	Trudy Dal'nevostoch- noi bazy AN SSSR	Transactions of the Academy of Sciences of the USSR
Tr. Inst. nov. lub. syr'ya	Trudy Instituta novogo lubyanogo syr'ya	Transactions of the Institute of New Fiber Raw Materials
Tr. Nauk.-Doslid. Inst. Bot. Khar. Derzh. Univ.	Trudy naukovо-doslid- noho instytutu botaniky Kharkivs'koho Derzhav- noho Universytetu	Transactions of the Botanical Research Institute of the Kharkov State University
Tr. Obshch. isp. prir. Khar'k. univ.	Trudy Obshchestva ispy- tatelei prirody Khar'kov- skogo universiteta	Transactions of the Natu- ralists' Society of Kharkov University
Tr. Obshch. sadov. v Odesse	Trudy Obshchestva sadovodov v Odesse	Transactions of the Odessa Horticulturists' Society
Tr. odesk. obsh. sadov.	Trudy odeskogo ob- shchestva sadovodov	Transactions of Odessa Horticulturists' Society

Tr. Peterb. obshch. es- testvoisp.	Trudy Peterburgskogo obshchestva estest- voispytatelei	Transactions of St. Peters- burg Naturalists' Society
Tr. pochv.-bot. eksp. Peresl. upr.	Trudy pochvennobota- nicheskoi ekspeditsii Pereslavskogo upravleniya	Transactions of the Soil- Botanical Expedition of Pereslavl Adminis- tration
Tr. po geobot. obsled. pastb. Azerb.	Trudy po geobotaniche- skim obsledovaniyam pastbishch Azerbaidzhana	Transactions of Geobotanical Investigations of Azerbai- jan Pastures
Tr. Odessk. otd. R. obshch. sador	Trudy Odesskogo otdele- niya Rossiiskogo ob- shchestva sadorvodov	Transactions of Odessa Branch of the Russian Horticulturists' Society
Tr. prikl. bot. (gen. i sel.)	Trudy po prikladnoi botanike, genetike i selektsii	Transactions of Applied Botany, Genetics and Selection
Tr. Ross. Obshch. sador.	Trudy Rossiiskogo ob- shchestva sadorvodov	Transactions of the Russian Horticulturists' Society
Tr. SAGU	Trudy Sredneaziatskogo Gosudarstvennogo Universiteta	Transactions of the Soviet Central Asian State University
Tr. Sarat. ob- shch. estestvoisp.	Trudy Saratovskogo obshchestva estest- voispytatelei	Transactions of the Saratov Naturalists' Society
Tr. Sil'skogospod. komit. bot.	Trudy sil'skogospodar'- skoho komiteta botaniky	Transactions of the Botanical Agricultural Committee
Tr. SPb. obshch. estestv.	Trudy Sankt-Peterburg- skogo obshchestva	Transactions of the St. Peters- burg Naturalists' Society
Tr. Tadzh. bazy AN SSSR	Trudy Tadzhikskoi bazy AN SSSR	Transactions of the Tadzhik- istan Base of the Academy of Sciences of the USSR
Tr. Tbil. bot. inst.	Trudy Tbilisskogo bota- nicheskogo instituta	Transactions of Tbilisi Botanical Institute
Tr. Tbil. (or Tifl.) bot. sada	Trudy Tbilisskogo (Tiflisskogo) bota- nicheskogo sada	Transactions of the Tbilisi (Tiflis) Botanical Garden
Tr. Turkmensk. bot. sada	Trudy Turkmenskogo botanicheskogo sada	Transactions of the Turk- menian Botanical Garden
Tr. Turk. nauchn. obshch.	Trudy Turkmenskogo nauchnogo obshchestva	Transactions of the Turk- menian Scientific Society
Uchen. Zapiski Kazansk. Gos. Univ.	Uchenye Zapiski Kazan- skogo Gosudarstven- nogo Universiteta	Scientific Reports of the Kazan State University
Vest. Akad. Nauk. (or AN) Kazakhsk. SSR	Vestnik Akademii Nauk Kazakhskoi SSR	Bulletin of the Academy of Sciences of the Kazakh SSR
Vestn. estestv. nauk	Vestnik estestven- nykh nauk	Bulletin of Natural Sciences
Vestn. Ross. Obshch. sador.	Vestnik Rossiiskogo Obshchestva sado- vodov	Bulletin of the Russian Horticulturists' Society

Vest. Tifl. bot. sada	Vestnik Tiflissskogo botanicheskogo sada	Bulletin of Tiflis Botanical Garden
Visn. Kyivsk. bot. sadu	Visnyk Kyivsk'koho botanichnoho sadu	Bulletin of the Kiev Botanical Garden
Vizn. (or Vznachn.) rosl. USSR	Viznachnyk roslyn USSR	Key to Plants of the Ukrainian SSR
V. obl. polupustyni Yadov. rast lugov i pastb.	V oblasti polupustyni Yadovitye rasteniya lugov i pastbishch	(In the) Semidesert Region Poisonous Plants of Meadows and Pastures
Yubil. sbornik V. L. Koma- rovu	Yubileinyi Sbornik Posvyashchennyi V. L. Komarovu	Jubilee Collection Dedicated to V. L. Komarov
Zam. po sist. i geogr. rast. Tbil. bot. inst.	Zametki po sistematike i geografii rastenii Tbilisskogo botaniche- skogo instituta	Notes on Taxonomy and Geography of Plants of the Tbilisi Botanical Institute
Zam. o Rast. Russk. Flory	Zametki o Rastenyakh Russkoi Flory	Notes on Plants of the Russian Flora
Zam. po fl. EL'T	Zametki po flore El'tona	Notes on the Flora of Elton
Zap. Kievsk. Obshch.	Zapiski Kievskogo Obshchestva Estest- voispytatelei	Reports of the Kiev Society of Naturalists
Zap. Kyivsk. Inst. Nar. Osv.	Zapysky Kyivsk'koho Instytutu Narodnoho Osvichennya	Reports of the Kiev Institute of Public Education
Zap. Nauchno- Prikl. Otd.	Zapiski Nauchno- Prikladnogo Otdela- niya Tiflissskogo Sada	Reports of the Applied Sciences Section of the Tiflis [Tbilisi] Botanical Garden
Zap. NOVO-ROSS. obshch. Estestv.	Zapiski Novorossi- skogo obshchestva Estestvoispytatelei	Reports of the Novorossiisk Society of Naturalists
Zap. Russk. geogr. obshch.	Zapiski Russkogo geo- graficheskogo obshchestva	Reports of the Russian Geographical Society
Zhurn. Bot. obshch.	Zhurnal Botanicheskogo obshchestva	Journal of the Botanical Society
Zhurn. opytn. agron. Yugo- Vost.	Zhurnal opytnoi agrono- mii Yugo-Vostoka	Journal of Experimental Agronomy of the Southeast



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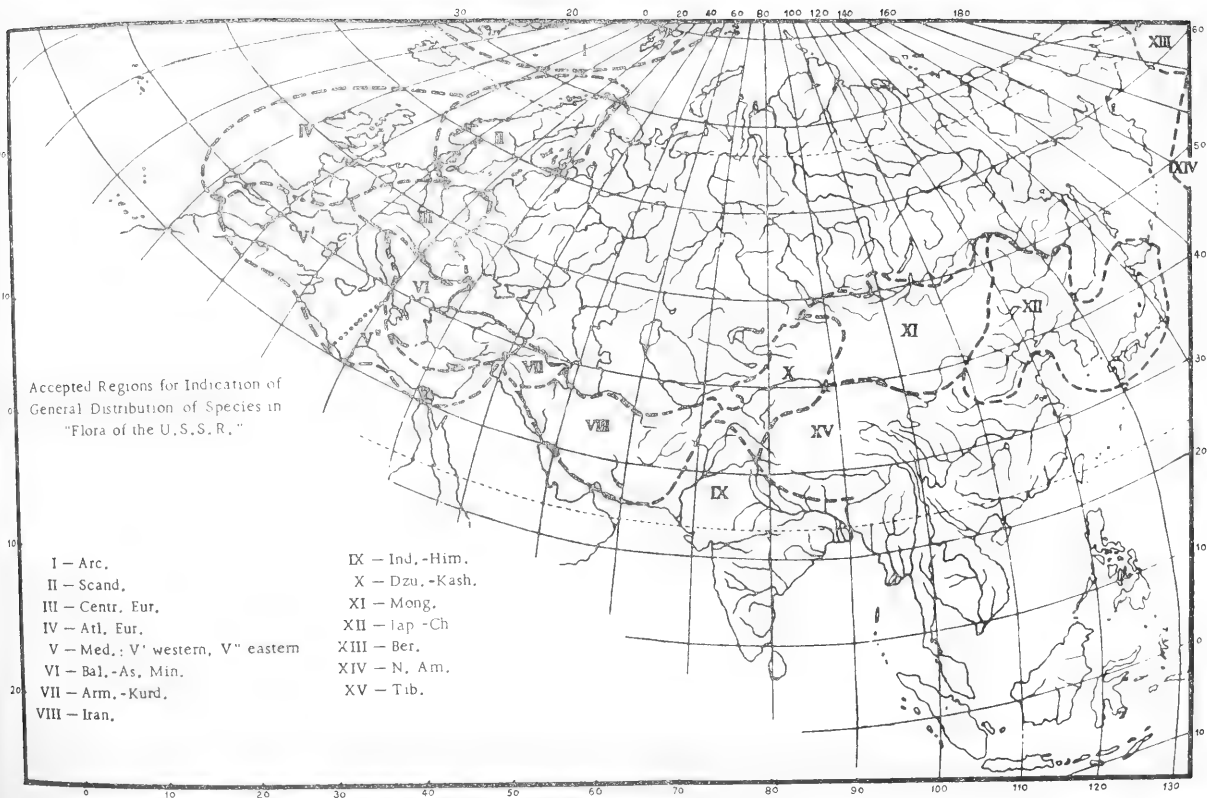
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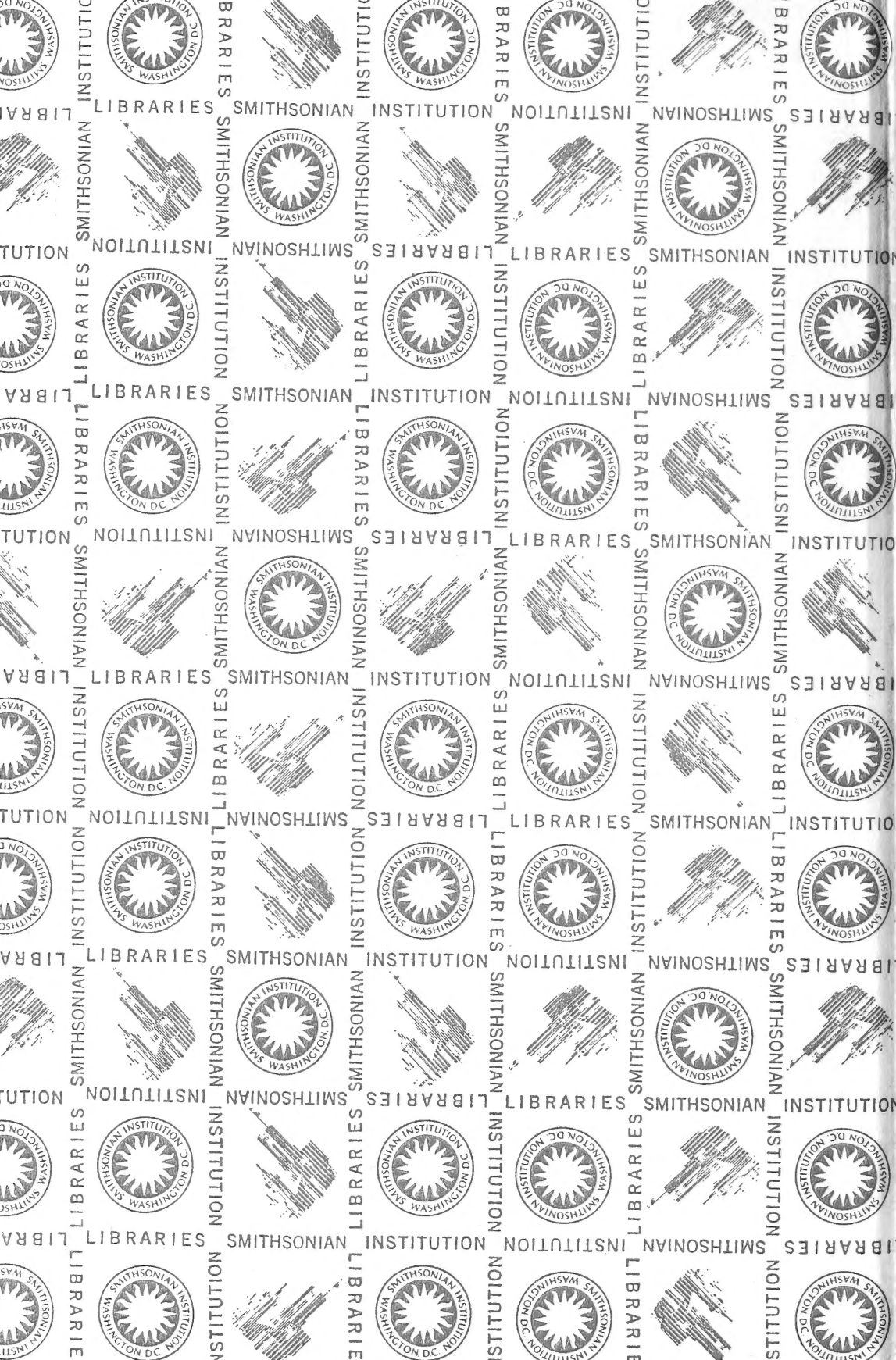
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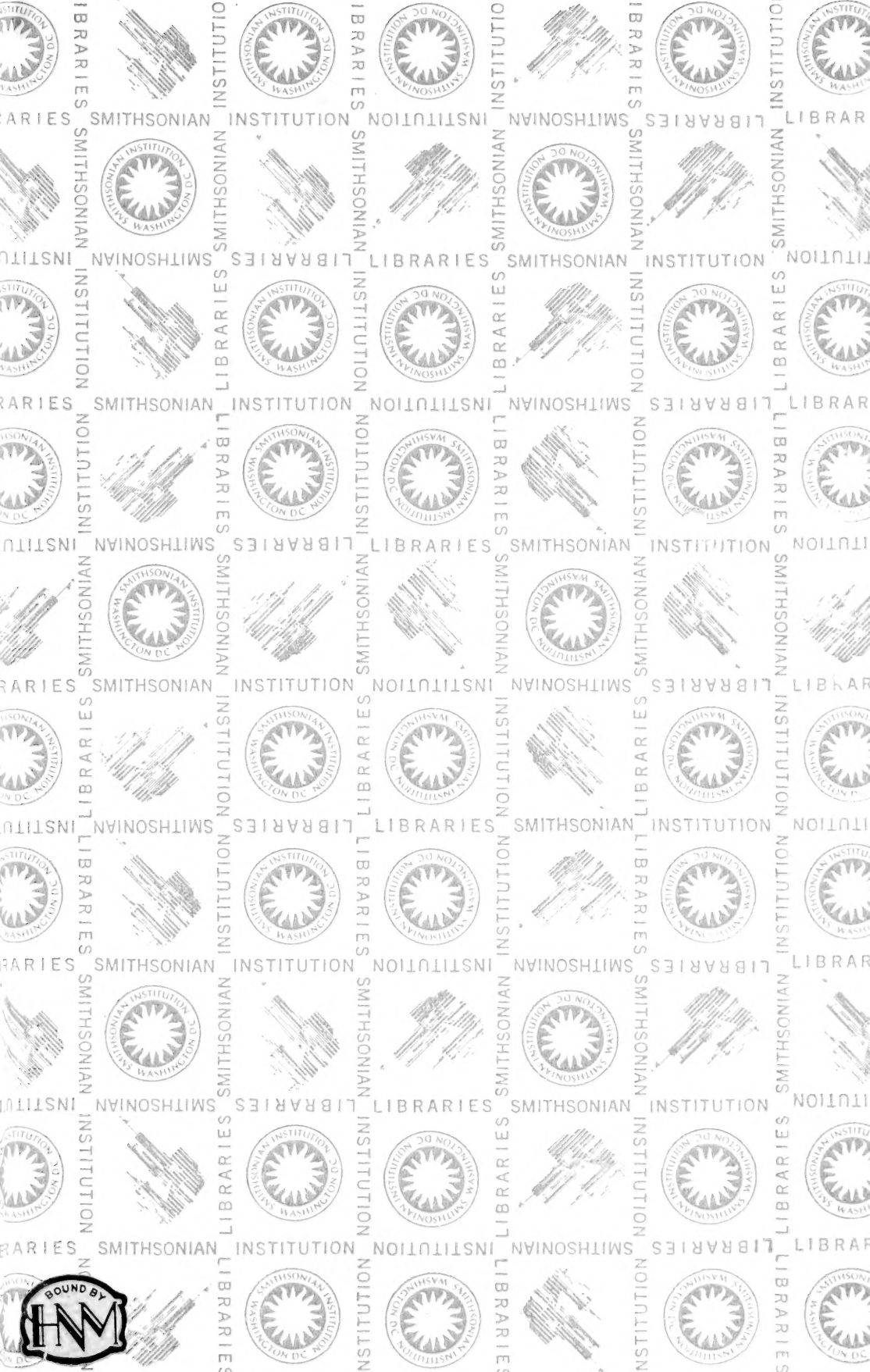












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